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## RESEARCH SUMMARY

The purpose of this annotated bibliography is to provide a working tool for natural resource specialists and land-use planners attempting to (1) describe understory production, density, or composition associated with specific overstories, or (2) changes in understory characteristics resulting from conversion or modification of specific overstories. The annotations include identification of major overstory species if given, location of study areas if not included in the title, and form of data presentation.

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# Understory- Overstory Vegetation Relationships: An Annotated Bibliography

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## INTRODUCTION

This bibliography is an update, through 1979, of an earlier bibliography on understory-overstory vegetation relationships that contained references published through 1971.<sup>1</sup> As with the earlier version, the purpose of this bibliography is to provide a working tool for natural resource specialists and land-use planners attempting to describe (a) understory production, density, or composition associated with specific overstories, or (b) changes in understory characteristics resulting from conversion or modification of specific overstories.

The terms **understory** and **overstory**, as used in this bibliography, are somewhat arbitrary. To qualify for listing in the bibliography, a reference must present information on interactions in production, density, or composition between two distinct levels of vertical stratification within a vegetation community. References were avoided in which forest understories consisted primarily of young trees, and not of an obviously different life form such as shrubs or herbs.

References in this bibliography include popular and scientific publications that, in general, can be found in readily available sources. Only references presenting quantitative information (tables, graphs, equations, etc.) have been listed. The annotations include identification of major overstory plant species, if given, location of study areas, if not included in the title, and form of data presentation.

To facilitate use, the bibliography has been organized by 10 regional categories, as follows:

1. Alaska;
2. Pacific Northwest, including Washington and Oregon;

3. California;
4. Intermountain, including Nevada, Utah, and southern Idaho;
5. Northern, including northern Idaho, Montana, and North Dakota;
6. Rocky Mountain, including Wyoming, South Dakota, Nebraska, Colorado, and Kansas;
7. Southwestern, including Arizona and New Mexico;
8. Eastern, including Minnesota, Iowa, Missouri, Illinois, Wisconsin, Michigan, Indiana, Ohio, West Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Rhode Island, Connecticut, Massachusetts, New Hampshire, Vermont, and Maine;
9. Southern, including Kentucky, Virginia, Tennessee, North Carolina, South Carolina, Georgia, Alabama, Florida, Mississippi, Louisiana, Arkansas, Oklahoma, and Texas; and
10. Outside of the United States.

Boundaries of the first nine categories coincide (for the most part) with administrative regions of the USDA Forest Service (fig. 1).

An index of authors is included to assist in the use of the bibliography. This index, arranged alphabetically by authors' surnames, lists the references in the bibliography for each author and coauthor.

<sup>1</sup>Ffolliott, Peter F., and Warren P. Clary. 1972. A selected and annotated bibliography of understory-overstory vegetation relationships. *Ariz. Agric. Exp. Stn., Tech. Bull.* 198, 33 p.

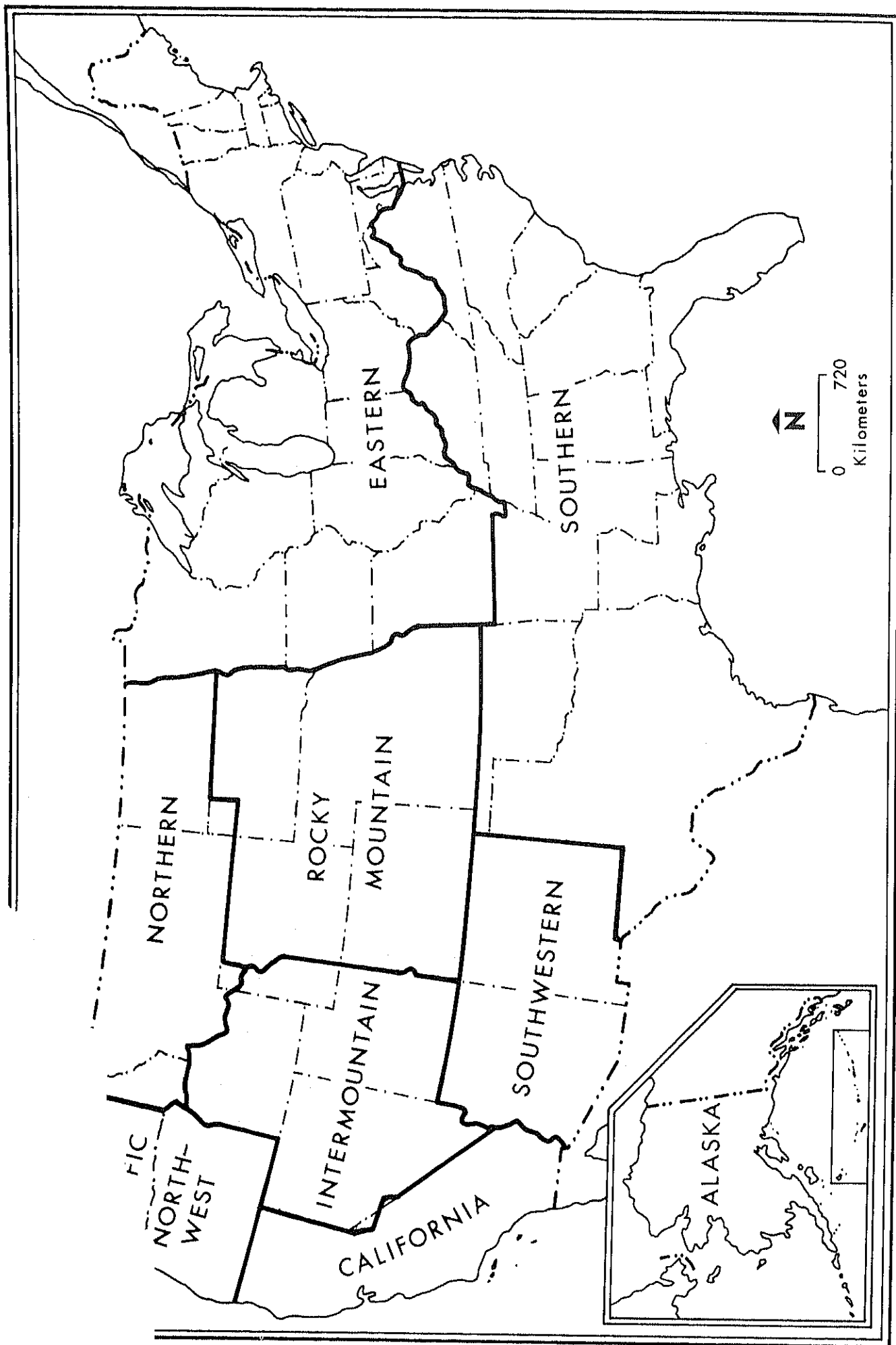


Figure 1.—Boundaries of regional categories within the United States.

## BIBLIOGRAPHY

### Alaska

1. BENNER, F. G., EDWARD C. CRAFTS, THEO C. HARTMAN, and LINCOLN ELLISON. 1938. A selected bibliography on management of western ranges, livestock, and wildlife. U.S. Dep. Agric. Misc. Publ. 281, 469 p.

Lists 8,274 publications through 1933 relating to grazing lands, domestic livestock, and wildlife production in Alaska and the 17 western states.

2. HARRIS, A. S. 1972. Natural reforestation after logging on Afognak Island. U.S. Dep. Agric. For. Serv., Res. Note PNW-176, 11 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Percent and height of ground cover on stocked and unstocked reforestation plots of sitka spruce (*Picea sitchensis*) 25 years after logging in Alaska are shown in tables.

### Pacific Northwest

3. BARRETT, JAMES W. 1965. Spacing and understory affect growth of ponderosa pine saplings. U.S. Dep. Agric. For. Serv., Res. Note PNW-27, 8 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

The influence of the removal of understory vegetation on diameter and height increments of suppressed ponderosa pine (*Pinus ponderosa*) saplings after harvest of overstory in Oregon is graphically illustrated.

4. BARRETT, JAMES W. 1968. Response of ponderosa pine pole stands to thinning. U.S. Dep. Agric. For. Serv., Res. Note PNW-77, 11 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Three years after thinning ponderosa pine (*Pinus ponderosa*) overstories in north-central Washington, understory yield was greater on thinned than on unthinned plots.

5. BARRETT, JAMES W. 1970. Ponderosa pine saplings respond to control of spacing and understory vegetation. U.S. Dep. Agric. For. Serv., Res. Pap. PNW-106, 16 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

A tree spacing study in central Oregon showed that thinning ponderosa pine overstories will stimulate growth of understory vegetation, with greater amounts of understory vegetation at wider spacings. Data are graphically illustrated.

6. BARRETT, JAMES W. 1973. Latest results from the Pringle Falls ponderosa pine spacing study. U.S. Dep. Agric. For. Serv., Res. Note PNW-209, 21 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Percent of ground covered by understory vegetation for various densities of *Pinus ponderosa* is illustrated by tables and graphs.

7. BARRETT, JAMES W., and C. T. YOUNGBERG. 1965. Effect of tree spacing and understory vegetation on water use in a pumice soil. Soil Sci. Soc. Am. Proc. 29:472-475.

The effects of understory vegetation and forest stand density on growth (diameter) of ponderosa pine (*Pinus ponderosa*) are described for a study area in central Oregon.

8. BURKHARDT, J. WAYNE, and E. W. TISDALE. 1969. Natural and successional status of western juniper vegetation in Idaho. J. Range Manage. 22:264-270.

Foliage cover and density of woody understory vegetation are presented (table) for climax and seral stands of western juniper (*Juniperus occidentalis*).

9. COCHRAN, P. H. 1975. Response of pole-size lodgepole pine to fertilization. U.S. Dep. Agric. For. Serv., Res. Note PNW-274, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

On the Winema National Forest, Oreg., plots of *Pinus contorta* were fertilized with ammonium sulfate (21-0-0 24% S), nitrogen as urea, and treble superphosphate (0-45-0), and untreated. Grass production (dry weight, lb/acre) on controlled and treated plots are shown (tables).

10. CROUCH, GLENN L. 1968. Forage availability in relation to browsing of Douglas-fir seedlings by black-tailed deer. J. Wildl. Manage. 32:542-553.

Deer forage production associated with different plant communities common to northwestern Oregon is given in tabular form.

11. DEALY, J. EDWARD. 1966. Bitterbrush nutrition levels under natural and thinned ponderosa pine. U.S. Dep. Agric. For. Serv., Res. Note PNW-33, 6 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Tables and graphs describing nutritional differences in antelope bitterbrush (*Purshia tridentata*) as influenced by different ponderosa pine (*Pinus ponderosa*) stocking levels are presented for a study area on the Pringle Falls Experimental Forest in central Oregon.

12. DEALY, J. EDWARD. 1971. Habitat characteristics of the Silver Lake mule deer range. U.S. Dep. Agric. For. Serv., Res. Pap. PNW-125, 99 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Understory and overstory cover and other information are presented for 21 tree- and shrub-dominated ecosystems in Lake County, Oreg.

13. DEALY, J. EDWARD. 1975. Management of lodgepole pine ecosystems for range and wildlife. In Manage. Lodgepole Pine Ecosystems, Symp. Proc. p. 556-568. Wash. State Univ., Pullman.

Understory response to a thinned lodgepole pine (*Pinus contorta*) stand in Oregon is described as a result of lo described.

16. DRISCOLL, RICHARD S. 1964. Vegetation-soil units in the central Oregon juniper zone. U.S. Dep. Agric. For. Serv., Res. Pap. PNW-19, 60 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.  
Cover, constancy, basal area, and density data are presented for nine associations of *Juniperus occidentalis*.
17. DYRNESS, C. T. 1965. The effect of logging and slash burning on understory vegetation in the H. J. Andrews Experimental Forest. U.S. Dep. Agric. For. Serv., Res. Note PNW-31, 13 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.  
Tables and graphs describe understory plant cover before logging, after logging, and after slash burning on a study area in the western Cascades. The timber before logging was dominantly Douglas-fir (*Pseudotsuga menziesii*) mixed with varying amounts of western hemlock (*Tsuga heterophylla*).
18. DYRNESS, C. T. 1973. Early stages of plant succession following logging and burning in the western Cascades of Oregon. *Ecology* 54:57-69.  
Changes in herbage production before logging, the first year after logging, and 5 years after slash burning *Pseudotsuga menziesii* on the H. J. Andrews Experimental Forest are given. Percent cover and frequency of plant species for 7 consecutive years are illustrated with tables and graphs.
19. EDGERTON, PAUL J. 1972. Big game use and habitat changes in a recently logged mixed conifer forest in northeastern Oregon. In *West Assoc. Game and Fish Comm.*, 52nd Annu. Conf. Proc. p. 239-246.  
On the Hoodoo and Mottet study areas, forests (*Abies grandis*, *Pseudotsuga menziesii*, and *Larix occidentalis*) were clearcut (slash burned and unburned), partially cut, and uncut. Percent foliage cover 5 years after logging is graphically illustrated.
20. FONDA, R. W. 1974. Forest succession in relation to river terrace development in Olympic National Park, Wash. *Ecology* 55:927-942.  
Four terrace levels of different ages in the floodway zone of the Hoh River were characterized. Percent cover and frequency of the understory vegetation of five forest communities (*Alnus rubra*, *Picea sitchensis*-*Tsuga heterophylla*-*Populus trichocarpa*, *Acer macrophyllum*, *Picea sitchensis*-*Tsuga heterophylla*, and *Tsuga heterophylla*) are given (table and graph).
21. FRANKLIN, JERRY F., and C. T. DYRNESS. 1973. Natural vegetation of Oregon and Washington. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. PNW-8, 417 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.  
Major vegetational units of Oregon and Washington are described. Percent canopy coverage of species (grasses, forbs, and shrubs) for numerous plant communities is given (table).
22. HEADY, HAROLD F., and JAMES BARTOLOME. 1977. The Vale Rangeland Rehabilitation Program: the desert repaired in southeastern Oregon. U.S. Dep. Agric. For. Serv., Resour. Bull. PNW-70, 139 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.  
Presents various information on relation of grass to *Artemisia* spp.
23. HEDRICK, D. W., D. N. HYDER, F. A. SNEVA, and C. E. POULTON. 1966. Ecological response of sagebrush-grass range in central Oregon to mechanical and chemical removal of *Artemisia*. *Ecology* 47:432-439.  
Herbage yields before and after removal (rotobating and spraying with 2,4-D) of sagebrush (*Artemisia tridentata*) overstory are graphically illustrated.
24. HYDER, DONALD N. 1954. Spray to control big sagebrush. Oreg. Agric. Exp. Stn., Corvallis, Bull. 538, 12 p.  
Herbage production before and after chemical control (2,4-D) of sagebrush (*Artemisia tridentata*) is discussed.
25. HYDER, DONALD N., and FORREST A. SNEVA. 1956. Herbage response to sagebrush spraying. *J. Range Manage.* 9:34-38.  
Grass and herbage yields are compared (table) among sprayed (2,4-D; 2,4,5-T), grubbed, and untreated areas of sagebrush (*Artemisia tridentata*) overstory in Oregon.
26. INGRAM, DOUGLAS C. 1931. Vegetative changes and grazing use on Douglas-fir cutover land. *J. Agric. Res.* 43:387-417.  
Density of understory vegetation before and after cutting and burning Douglas-fir (*Pseudotsuga taxifolia*) overstory is given (table) for the Cascade Mountains in Oregon and Washington.
27. JACKSON, M. T., and ADOLPH FALLER. 1973. Structural analysis and dynamics of the plant communities of Wizard Island, Crater Lake National Park. *Ecol. Monogr.* 43:441-461.  
Density values for the herbaceous species in the five major communities (cinder slope [*Polygonum newberryi*-*Eriogonum pyrolaeifolium* var. *coryphaeum*], crater rim [*Pinus albicaulis*], lower cone [*Abies magnifica* var. *shastensis*], north slope [*Tsuga mertensiana*], and lava flow [*Tsuga mertensiana*-*Sambucus microbotrys*]) that comprise the study area are given (table).
28. LONG, JAMES N., and J. TURNER. 1975. Aboveground biomass of understory and overstory in age sequence of four Douglas-fir stands. *J. Appl. Ecol.* 12:179-188.  
Above ground biomass for herbs and shrubs growing under *Pseudotsuga menziesii* of various ages (22, 30, 42, and 73 years) near the A. E. Thompson Research Center, Wash., is given (table).
29. McCONNELL, BURT R., and JUSTING. SMITH. 1965. Understory response three years after thinning pine. *J. Range Manage.* 18:129-132.  
Linear prediction equations describe increase in yield of understory vegetation after thinning ponderosa pine (*Pinus ponderosa*) overstory as a function of residual growing area per tree, percent overstory canopy, and overstory density. The equations represent data from a study area in north-central Washington.
30. McCONNELL, BURT R., and JUSTIN G. SMITH. 1970. Response of understory vegetation to ponderosa pine thinning in eastern Washington. *J. Range Manage.* 23:208-212.  
A curvilinear (positive) relationship between increase in yield of understory vegetation 8 years after thinning ponderosa pine (*Pinus ponderosa*) and residual tree spacing is described. Also, a linear (negative) relationship between increase in yield of understory vegetation and percent overstory canopy is given.
31. McCONNELL, BURT R., and JUSTING. SMITH. 1971. Effect of ponderosa pine needle litter on grass seedling survival. U.S. Dep. Agric. For. Serv., Res. Note PNW-155, 6 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.  
Density of hard fescue (*Festuca ovina*) under different levels of ponderosa pine (*Pinus ponderosa*) needle accumulation is illustrated (graph) for a study area in Washington.
32. MILLER, A. E. 1957. Sagebrush control. *Soil Conserv.* 23:18-19. Grass production with and without chemical control of sagebrush is given for the State of Washington.

33. MILLER, RICHARD F., and WILLIAM C. KRUEGER. 1976. Cattle use on summer foothill rangelands in north-eastern Oregon. *J. Range Manage.* 29:367-371.  
Herbage production under different overstory canopy covers in the Wallowa Mountains is discussed and linear coefficients of determination are given. Tree species are ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and grand fir (*Abies grandis*).
34. MOIR, WILLIAM H. 1966. Influence of ponderosa pine on herbaceous vegetation. *Ecology* 47:1045-1048.  
In Washington, field and experimental data presented (tables and graphs) suggest that ponderosa pine (*Pinus ponderosa*) developed past the seedling stage suppresses herbaceous vegetation.
35. NEILAND, BONITA J. 1958. Forest and adjacent burn in the Tillamook burn area of northwestern Oregon. *Ecology* 39:660-671.  
The composition of herbaceous vegetation is presented (tables) for burned and unburned coniferous forests in the Oregon Coast Range. Dominant overstory species include Douglas-fir (*Pseudotsuga taxifolia*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and various true firs (*Abies* spp.).
36. RITTENHOUSE, L. R., and F. A. SNEVA. 1976. Expressing the competitive relationship between Wyoming big sagebrush and crested wheatgrass. *J. Range Manage.* 29:326-327.  
Linear regression was used to express the relation between grass production and crown cover of *Artemisia tridentata* on the Squaw Butte Experiment Station, Ore.
37. RUMMELL, ROBERT S. 1951. Some effects of livestock grazing on ponderosa pine forest and range in central Washington. *Ecology* 32:594-607.  
Average densities of herbaceous vegetation are described (table and graph) for open ponderosa pine (*Pinus ponderosa*), mixed ponderosa pine—Douglas-fir (*Pseudotsuga taxifolia*), and grassland vegetative types.
38. SASSAMAN, ROBERT W., JAMES W. BARRETT, and JUSTIN G. SMITH. 1973. Economics of thinning stagnated ponderosa pine sapling stands in the pine-grass areas of central Washington. U.S. Dep. Agric. For. Serv., Res. Pap. PNW-144, 17 p. Pac. Northwest For. and Range Exp. Stn., Portland, Ore.  
Ponderosa pine (*Pinus ponderosa*) stands were thinned to assess the effects of treatments upon the economic returns. Percent of composition of grasses, forbs, and shrubs after thinning is tabulated.
39. SHERMAN, ROBERT J., and WILLIAM W. CHILCOTE. 1972. Spatial and chronological patterns of *Purshia tridentata* as influenced by *Pinus ponderosa*. *Ecology* 53:294-298.  
Between Suttle Lake and Sisters, Ore., 10 plots, each consisting of a single ponderosa pine tree and surrounding antelope bitterbrush, were selected to compare *Purshia* resprouting and repopulation 23 to 106 years following fire (no fire on one plot). *Purshia* density, number of plants per clump, and percentage clumping for each plot are tabulated.
40. SKOVLIN, JON M., ROBERT W. HARRIS, GERALD S. STRICKLER, and GEORGE A. GARRISON. 1976. Effects of cattle grazing methods on ponderosa pine - bunchgrass range in the Pacific Northwest. U.S. Dep. Agric. For. Serv., Tech. Bull. 1531, 40 p. Washington, D.C.  
The relation between *Pinus ponderosa* canopy cover and understory herbage production is described for the Blue Mountains of northeastern Oregon and southeastern Washington.
41. SNEVA, FORREST A. 1972. Grazing return following sagebrush control in eastern Oregon. *J. Range Manage.* 25:174-178.  
On the Squaw Butte Experiment Station, *Artemisia tridentata* was treated with 2,4-D. Herbage yields following treatment are presented graphically.
42. STRICKLER, GERALD S. 1965. Soil and vegetation on the Starkey Experimental Forest and Range. *Proc. Soc. Am. For.* 1965:27-30.  
Herbage production values are given for grassland and open *Pinus ponderosa* and *Pseudotsuga menziesii* stands in eastern Oregon.
43. STUTH, JERRY W., and A. H. WINWARD. 1976. Logging impacts on bitterbrush lodgepole pine-pumice region of central Oregon. *J. Range Manage.* 29:453-456.  
Shrub and herbaceous production for unlogged and logged conditions is tabulated. Overstory is predominantly *Pinus contorta*.
44. TIEDEMANN, ARTHUR R., and GLEN O. KLOCK. 1973. First-year vegetation after fire, reseeding, and fertilization on the Entiat Experimental Forest. U.S. Dep. Agric. For. Serv., Res. Note PNW-195, 23 p. Pac. Northwest For. and Range Exp. Stn., Portland, Ore.  
Following a severe burn of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) dominants, four watersheds were treated differently: seeded and fertilized with 54 kg/ha of N as urea; seeded and fertilized with 57 kg/ha of N as ammonium sulfate; seeded only; and untreated. Cover and frequency of understory vegetation following treatments are given (tables and graphs).
45. WILLIAMSON, RICHARD L., and ROBERT H. RUTH. 1976. Results of shelterwood cutting in western hemlock. U.S. Dep. Agric. For. Serv., Res. Pap. PNW-201, 25 p. Pac. Northwest For. and Range Exp. Stn., Portland, Ore.  
A three-stage shelterwood harvesting system establishing 12 densities of western hemlock (*Tsuga heterophylla*) on the Hemlock Experimental Forest was studied. The influence of time since cutting on the percent canopy coverage of herbs and shrubs is graphically illustrated.
46. YOUNG, J. A., D. W. HEDRICK, and R. F. KENISTON. 1967. Forest cover and logging: herbage and browse production in mixed coniferous forest of northeastern Oregon. *J. For.* 65:807-813.  
Herbage and browse production under overstory cover classes is given in a table. Mixed coniferous overstory is predominantly grand fir (*Abies grandis*), Douglas-fir (*Pseudotsuga menziesii*), and western larch (*Larix occidentalis*).

47. ZOBEL, DONALD B., ARTHUR McKEE, GLENN M. HAWK, and C. T. DYRNESS. 1976. Relationships of environment to composition, structure, and diversity of forest communities of the central western Cascades of Oregon. *Ecol. Monogr.* 46:135-156.

The percent cover of shrubs and herbs for communities in three vegetation zones (*Tsuga heterophylla*, *Abies amabilis*, and a transition zone) is given (table).

## California

48. ADAMS, LOWELL, and DAVID J. DUNAWAY. 1960. The effect of timber overstory on deer habitat in mixed conifer type. U.S. Dep. Agric. For. Serv., Res. Note PSW-158, 2 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

A logarithmic relationship between understory and overstory densities is graphically illustrated for a study area on the west slope of the Sierra Nevada in California.

49. AGEE, JAMES K., and HAROLD H. BISWELL. 1970. Some effects of thinning on ponderosa pine and understory vegetation. *J. For.* 68:709-711.

Herbaceous vegetation production under thinned, fertilized ( $(\text{NH}_4)_2\text{SO}_4$ ), thinned and fertilized, and no treatment (control) stands of ponderosa pine (*Pinus ponderosa*) overstory in California is described.

50. CHABOT, BRIAN F., and W. D. BILLINGS. 1972. Origins and ecology of the Sierran alpine flora and vegetation. *Ecol. Monogr.* 42:163-199.

A transect from the desert near Bishop, Calif., to Piute Pass in the Sierra Nevada reveals four communities: desert shrub (*Ephedra nevadensis*-*Tetradymia spinosa*), open woodland (*Pinus monophylla*-*Artemisia tridentata*), open forest (*Pinus jeffreyi*-*Pinus murrayana*), and subalpine herbaceous vegetation (*Pinus albicaulis*). Percent cover of each species present at the four elevations is given (table).

51. CORNELIUS, DONALD R., and CHARLES H. GRAHAM. 1951. Selective herbicides for improving California forest ranges. *J. Range Manage.* 4:95-100.

Grass production under sprayed (2,4-D) and unsprayed sagebrush (*Artemisia tridentata*) is given for the ponderosa-Jeffrey pine forest zone of northeastern California.

52. GAYLORD, VERNON J., and STANLEY E. WESTFALL. 1971. Wedgeleaf ceanothus canopy does not affect total herbage yield. U.S. Dep. Agric. For. Serv., Res. Note PSW-253, 4 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Herbage yield associated with wedgeleaf ceanothus (*Ceanothus cuneatus*) overstory is presented (tables) for a study area on the San Joaquin Experimental Range in central California.

53. GORDON, DONALD T. 1962. Growth response of east side poles to removal of low vegetation. U.S. Dep. Agric. For. Serv., Res. Note PSW-209, 3 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Differences in growth of ponderosa and Jeffrey pine after removal of grasses, broad-leaved plants, and all understory vegetation are presented (tables) for a study area in northeastern California.

54. JOHNSON, WALTER, CYRUS M. McKELL, RAYMOND A. EVANS, and L. J. BERRY. 1959. Yield and quality of annual range forage following 2,4-D application on blue oak trees. *J. Range Manage.* 12:18-20.

Botanical composition, yield, percent crude protein, and percent phosphorus of herbage under treated (2,4-D) and untreated stands of blue oak (*Quercus douglasii*) are presented (tables) for the Sierra-Nevada foothills of California.

55. HANES, TED L., and HAROLD W. JONES. 1967. Postfire chaparral succession in southern California. *Ecology* 48:259-264.

Pre- and postfire vegetation are compared (table and graphs) for two chaparral stands in the San Gabriel Mountains.

56. MURPHY, ALFRED H., and BEECHER CRAMPTON. 1964. Quality and yield of forage as affected by chemical removal of blue oak (*Quercus douglasii*). *J. Range Manage.* 17:142-144.

Herbage yields under treated (2,4-D) and untreated blue oak stands and in open areas are described for the grass-woodland cover type in California.

57. PERRY, CHESTER A., CYRUS M. McKELL, JOE R. GOODIN, and THOMAS M. LITTLE. 1967. Chemical control of an old stand of chaparral to increase range productivity. *J. Range Manage.* 20:166-169.

Tables of grass production under sprayed (2,4-D; 2,4,5-T) and unsprayed stands of purple sage (*Salvia leucophylla*), chamise (*Adenostoma fasciculatum*), and California lilac (*Ceanothus* spp.) are presented for study sites in southern California.

58. RATLIFF, RAYMOND D., JACK N. REPPERT, and RICHARD J. McCONNEN. 1972. Rest rotation grazing at Harvey Valley: range health, cattle gains, costs. U.S. Dep. Agric. For. Serv., Res. Pap. PSW-77, 24 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

In the southern Cascades of California, two grazing treatments (rest-rotation and season long) were studied on plots dominated by silver sagebrush (*Artemisia cana*), black sagebrush (*A. arbuscula*), shorthair sedge (*Carex exserta*), ponderosa pine (*Pinus ponderosa*), and fir (*Abies* spp.). Herbage yield and percent cover of understory species for the two grazing treatments are given (tables).

59. SCHIMKE, HARRY E., LISLE E. GREEN, and DANNY HEAVILIN. 1970. Perennial grasses reduce woody plant seedlings on mixed conifer fuel-break. U.S. Dep. Agric. For. Serv., Res. Note PSW-203, 4 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Gives tabular data on relation of grass cover and density to growth of *Arctostaphylos viscida* seedlings in central California.

60. ST. ANDRE, G., H. A. MOONEY, and R. D. WRIGHT. 1965. The pinyon woodland zone in the White Mountains of California. *Am. Midl. Nat.* 73:225-239.

Understory (herbaceous and shrubby) cover and density are compared (table) to singleleaf pinyon (*Pinus monophylla*) overstory cover and density.

61. VOGL, RICHARD J. 1973. Ecology of knobcone pine in the Santa Ana Mountains, California. *Ecol. Monogr.* 43:125-143.

Average percent cover and number of plants per acre for species on unburned and burned knobcone pine (*Pinus attenuata*) stands is given (table).

62. VOGL, RICHARD J., and PAUL K. SCHORR. 1972. Fire and manzanita chaparral in the San Jacinto Mountains, California. *Ecology* 53:1179-1188.

In the California Peninsular Range Province, the floristic composition of plots dominated by *Arctostaphylos glandulosa* was changed following fire. Percent cover of herbaceous plants and grasses on plots 1 and 2 years following burning and on an unburned area are tabulated.

63. YOUNG, JAMES A., and RAYMOND A. EVANS. 1971. Medusahead invasion as influenced by herbicides and grazing on low sagebrush sites. *J. Range Manage.* 24:451-454.

In a low sagebrush (*Artemisia arbuscula*) community near Adin, Calif., both grazed and ungrazed plots were treated in one of three ways: application of 2,4-D, application of 2,4-D plus atrazine, and no application. Herbage yield, percent cover, and species composition (percent) for the six treatments are tabulated. Also, percent cover by year for grazed and ungrazed plots is given (graph).

## Intermountain

64. BARNEY, MILO H., and NEIL C. FRISCHKNECHT. 1974. Vegetation changes following fire in the pinyon-juniper type of west-central Utah. *J. Range Manage.* 27:91-96.

Comparative changes of grasses, sagebrush (*Artemisia* spp.), and Utah juniper (*Juniperus osteosperma*) after fire are graphically illustrated.

65. BARTOS, DALE L. 1979. Effects of burning on the aspen ecosystem. In *Wyoming Shrublands*, Proc. Eighth Wyo. Shrub Ecol. Workshop. p. 47-58. *Range Manage. Div.*, Univ. Wyo., Laramie.

Graphic presentation of understory response to burning of *Populus tremuloides* in Bridger-Teton National Forest.

66. BLACKBURN, WILBERT H., and PAUL T. TUELLER. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada. *Ecology* 51:841-848.

Tabular and graphic information on understory frequency and cover are presented for *Pinus monophylla* and *Juniperus osteosperma* overstory.

67. BLAISDELL, JAMES P. 1949. Competition between sagebrush seedlings and reseeded grasses. *Ecology* 30:512-519.

Graphic and tabular data show relation between herbage yields and amount of *Artemisia tridentata* in Clark County, Idaho.

68. BLAISDELL, JAMES P. 1950. Effects of controlled burning on bitterbrush on the Upper Snake River Plains. U.S. Dep. Agric. For. Serv., Intermt. For. and Range Exp. Stn., Res. Pap. 20, 3 p. Ogden, Utah.

Tabular values are given for herbage production versus percent unburned *Purshia tridentata* in Idaho.

69. BLAISDELL, JAMES P. 1953. Ecological effects of planned burning of sagebrush-grass ranges on the Upper Snake River Plains. U.S. Dep. Agric., Tech. Bull. 1075, 39 p. Washington, D.C.

Herbage production in relation to different intensities of burning, including no burning, is given for big sagebrush (*Artemisia tridentata*) stands in Idaho.

70. BLEAK, A. T., and WARREN G. MILLER. 1955.

Sagebrush seedling production as related to time of mechanical eradication. *J. Range Manage.* 27:91-96. For Humboldt County, Nev., number of *Artemisia tridentata* plants present after attempted eradication and the number of crested wheatgrass seedlings are tabulated.

71. BRITTON, CARLTON M., and MICHAEL H.

RALPHS. 1979. Use of fire as a management tool in sagebrush ecosystems. In *The sagebrush ecosystem: a symposium* [April 1978]. p. 101-109. Utah State Univ., College Nat. Resour., Logan.

Provides an hypothetical graphic relation between herbaceous fuel and *Artemisia* canopy cover for the western United States.

72. BROWN, JAMES K. 1974. Reducing fire potential in lodgepole pine by increasing timber utilization. U.S. Dep. Agric. For. Serv., Res. Note INT-181, 6 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

On the Teton National Forest, lodgepole pine (*Pinus contorta*) was clearcut and logged to near-complete and conventional utilization standards to assess the difference in fire potential for the two treatments. The percent cover of grass before and after near-complete and conventional utilization is tabulated.

73. COLLINS, WILLIAM B., PHILIP J. URNESS, and DENNIS D. AUSTIN. 1978. Elk diets and activities on different lodgepole pine habitat segments. *J. Wildl. Manage.* 42:799-810.

Herbage characteristics with and without *Pinus contorta* forest overstories are presented in tabular form for a study area in northeastern Utah.

74. COOK, C. WAYNE. 1958. Sagebrush eradication and broadcast seeding. *Utah Agric. Exp. Stn. Bull.* 404, 23 p.

Regression coefficients are given relating grass production to percent *Artemisia tridentata* cover and density in central Utah.

75. COOK, C. WAYNE. 1966. Development and use of foothill ranges in Utah. *Utah Agric. Exp. Stn. Bull.* 461, 47 p.

Tabular data are presented comparing grass production on native untreated areas and areas with control of *Artemisia tridentata* and seeding to exotic grasses.

76. COOK, C. WAYNE, and CLIFFORD E. LEWIS. 1963. Competition between big sagebrush and seeded grasses on foothill ranges in Utah. *J. Range Manage.* 16:245-250.

Seeded grass production is presented (table) for sprayed (2,4-D) and unsprayed areas of big sagebrush (*Artemisia tridentata*).

77. DESCHAMP, JOSEPH A., PHILIP J. URNESS, and DENNIS D. AUSTIN. 1979. Summer diets of mule deer from lodgepole pine habitats. *J. Wildl. Manage.* 43:154-161.

Understory information for different segments of a *Pinus contorta* forest in Utah is presented in tabular and graphic forms.

78. DWYER, DON D. 1975. Response of livestock forage to manipulation of the pinyon-juniper ecosystem. In *The pinyon-juniper ecosystem: a symposium* [May 1975]. p. 97-103. Utah State Univ., Coll. Nat. Resour., Logan.

Provides a summary of several studies that document the effect of pinyon-juniper stands on forage production in the West.



79. ECKERT, RICHARD E., JR., ALLEN D. BRUNER, and GERALD J. KLOMP. 1972. Response of understory species following herbicidal control of low sagebrush. *J. Range Manage.* 25:280-285.  
Increases in herbage yields were studied in northern Nevada following the removal of *Artemisia arbuscula* and *A. longiloba*. Differences in yield are shown in graphic form; site-affected response is also discussed.
80. ELLISON, LINCOLN, and WALTER R. HOUSTON. 1958. Production of herbaceous vegetation in openings and under canopies of western aspen. *Ecology* 39:337-345.  
Production of different artificially seeded herbaceous species under aspen (*Populus tremuloides*) canopies and in openings is given (tables) for a study area in central Utah.
81. EVANS, RAYMOND A., and JAMES A. YOUNG. 1975. Aerial application of 2,4-D plus picloram for green rabbitbrush control. *J. Range Manage.* 28:315-318.  
Tabulations compare herbage yields with and without chemical control of *Chrysothamnus viscidiflorus* near Reno, Nev.
82. EVANS, RAYMOND A., and JAMES A. YOUNG. 1978. Effectiveness of rehabilitation practices following wild-fire in a degraded big sagebrush-downy brome community. *J. Range Manage.* 31:185-188.  
Benefits of chemically controlling *Chrysothamnus viscidiflorus* and *Tetradymia canescens* following wildfire in *Artemisia tridentata* grasslands were studied in western Nevada. Density of understory plants is given in tabular form.
83. FRISCHKNECHT, NEIL C. 1963. Contrasting effects of big sagebrush and rubber rabbitbrush on production of crested wheatgrass. *J. Range Manage.* 16:70-74.  
Grass production on study plots with and without big sagebrush (*Artemisia tridentata*) and rubber rabbitbrush (*Chrysothamnus nauseosus*) is described for the Benmore Experimental Range in west-central Utah.
84. GREENWOOD, LARRY R., and JACK D. BROTHERRSON. 1978. Ecological relationships between pinyon-juniper and true mountain mahogany stands in the Uintah Basin, Utah. *J. Range Manage.* 31:164-167.  
The frequencies of various understory species are given for sites dominated by *Cercocarpus montanus*, *Pinus edulis*, and *Juniperus osteosperma*.
85. HARNISS, ROY O., and ROBERT B. MURRAY. 1973. Thirty years of vegetal change following burning of sagebrush-grass range. *J. Range Manage.* 26:322-325.  
Total grass production was studied as an *Artemisia tridentata* range recovered after burning in Upper Snake River Plains of Idaho. Changes over time are presented in graphs and tables.
86. HULL, A. C., JR., and G. J. KLOMP. 1974. Yield of crested wheatgrass under four densities of big sagebrush in southern Idaho. U.S. Dep. Agric. For. Serv. Tech. Bull. 1483, 38 p.  
Tabular and graphic data are presented on the relation of percent removal of big sagebrush and the resulting grass production per acre.
87. JENSEN, NEIL E. 1972. Pinyon-juniper woodland management for multiple use benefits. *J. Range Manage.* 25:231-234.  
The effects of singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) removal (pruning, thinning, and weeding) on antelope bitterbrush (*Purshia tridentata*) and on herbage production on the Toiyabe National Forest, Nev., are discussed.
88. LAYCOCK, WILLIAM A., and THOMAS A. PHILLIPS. 1968. Long-term effects of 2,4-D on lanceleaf rabbitbrush and associated species. *J. Range Manage.* 21:90-93.  
In Nevada, herbage yields on sprayed (2,4-D) and unsprayed areas supporting lanceleaf rabbitbrush (*Chrysothamnus viscidiflorus*) overstory are given in tabular form.
89. LORD, PHILIP B., and WILLIAM H. SANDERSON. 1962. An eastside Sierra Nevada aerial spraying project. *J. Range Manage.* 15:200-201.  
Plant frequency of herbaceous plants and shrubs is given before and after spraying (2,4-D) the overstory of big sagebrush (*Artemisia tridentata*), black sagebrush (*A. arbuscula*), and antelope bitterbrush (*Purshia tridentata*).
90. MARSTON, RICHARD B., and ODELL JULANDER. 1961. Plant cover reductions by pocket gophers following experimental removal of aspen from a watershed area in Utah. *J. For.* 59:100-102.  
A table presents the increase in herbaceous ground cover before and after aspen (*Populus tremuloides*) removal.
91. MUEGGLER, WALTER F. 1950. Effects of spring and fall grazing by sheep on vegetation of the Upper Snake River Plains. *J. Range Manage.* 3:308-315.  
Cover and production for *Artemisia tripartita* overstory and herbaceous understory are presented in tabular form for Idaho.
92. MUEGGLER, WALTER F., and JAMES P. BLAISDELL. 1958. Effects on associated species of burning, rotobating, spraying, and railing sagebrush. *J. Range Manage.* 11:61-66.  
Herbage yields associated with untreated big sagebrush (*Artemisia tridentata*) overstory and with overstory reduced by various methods are presented in a graph and a table for a study area on the Upper Snake River Plains.
93. MUEGGLER, W. F., and D. L. BARTOS. 1977. Grindstone Flat and Big Flat exclosures: a 41 year record of changes in clearcut aspen communities. U.S. Dep. Agric. For. Serv., Res. Pap. INT-195, 16 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.  
The effects of aspen (*Populus tremuloides*) cutting on sprout, shrub, and herbage production in old exclosures in southeastern Utah are displayed in tabular form.
94. NIELSEN, DARWIN B., and STAN D. HINCKLEY. 1975. Economic and environmental impacts of sagebrush control on Utah's rangelands—a review and analysis. Utah Agric. Exp. Stn., Logan, Res. Rep. 25, 27 p.  
Summarizes data on forage production with and without control of sagebrush.

95. ORR, HOWARD K. 1957. Effects of plowing and seeding on some forage production and hydrologic characteristics of a subalpine range in central Utah. U.S. Dep. Agric. For. Serv., Res. Pap. 47, 23 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.  
Ground cover and forage production are given (tables) for treated (plowed and seeded) and untreated study plots on subalpine-herbaceous range. Overstory includes Engelmann spruce, alpine fir, and limber pine.
96. PATTEN, D. T. 1969. Succession from sagebrush to mixed conifer forest in the northern Rocky Mountains. *Am. Midl. Nat.* 82:229-240.  
The frequency and aerial cover of herbaceous plants and shrubs, and the frequency, density, and basal area of young mixed conifers are described (table) in relation to sagebrush (*Artemisia tridentata*) and lodgepole pine (*Pinus contorta*) overstory conditions. The study site was in Yellowstone National Park.
97. PECHANEC, JOSEPH F., GEORGE STEWART, and JAMES P. BLAISDELL. 1954. Sagebrush burning: good and bad. U.S. Dep. Agric., Farmers' Bull. 1948, 34 p.  
Herbage production on burned and unburned big sagebrush (*Artemisia tridentata*) ranges on the Upper Snake River Plains in Idaho is graphically illustrated.
98. PHILLIPS, T. A. 1977. An analysis of some Forest Service pinyon-juniper chaining projects in Region 4—1954-1975. U.S. Dep. Agric. For. Serv., Range Improve. Notes (Sept. 1977), p. 1-20. Intermt. Region, Ogden, Utah.  
Data presented show an increase in forage production on a variety of sites in Utah and Nevada after pinyon-juniper removal.
99. PHILLIPS, T. A. 1979. North Cedars pinyon-juniper studies. U.S. Dep. Agric. For. Serv., Range Improve. Notes (Nov. 1979), p. 1-12. Intermt. Region, Ogden, Utah.  
Tabular data are presented for grass, forb, and shrub production on chained and control *Pinus edulis-Juniperus osteosperma* areas in southern Utah.
100. RALPHS, MICHAEL H., and FRANK E. BUSBY. 1979. Prescribed burning: vegetation change, forage production, cost, and returns on six demonstration burns in Utah. *J. Range Manage.* 32:267-270.  
Forage production is given in tabular form for burned and unburned *Artemisia tridentata*.
101. ROBERTSON, JOSEPH H. 1947. Response of range grasses to different intensities of competition with sagebrush (*Artemisia tridentata* Nutt.). *Ecology* 28:1-16.  
Production of herbage per grass plant in relation to root competition from *Artemisia tridentata* in northern Nevada is graphically illustrated.
102. ROBERTSON, J. H. 1969. Yield of crested wheatgrass following release from sagebrush competition by 2,4-D. *J. Range Manage.* 22:287-288.  
Yields of crested wheatgrass (*Agropyron desertorum*) on sprayed (2,4-D) and unsprayed study plots with sagebrush (*Artemisia tridentata*) overstory are given for Nevada (table).
103. ROBERTSON, J. H. 1971. Changes on a sagebrush-grass range in Nevada ungrazed for 30 years. *J. Range Manage.* 24:297-400.  
Annual production of forage grasses on planted and cleared, seeded ranges is given (table) for big sagebrush-Sandberg bluegrass (*Artemisia tridentata-Poa secunda*) type.
104. ROBERTSON, JOSEPH H. 1972. Competition between big sagebrush and crested wheatgrass. *J. Range Manage.* 25:156-157.  
Mortality of *Artemisia tridentata* related to moisture competition with *Agropyron desertorum* is discussed for a study area in Nevada.
105. SCHUMAKER, GILBERT A., AND CLAYTON L. HANSON. 1977. Herbage response after mechanical and herbicide treatment of big sagebrush in southwest Idaho. U.S. Dep. Agric., Agric. Res. Serv. Publ. W-46, 15 p.  
Tabular and graphic data are presented for treated and untreated *Artemisia tridentata*.
106. SMITH, ARTHUR D., PAUL A. LUCAS, CALVIN O. BAKER, AND GEORGE W. SCOTTER. 1972. The effects of deer and domestic livestock on aspen regeneration in Utah. Utah Div. Wildl. Resour., Salt Lake City, Publ. 72-1, 32 p.  
Herbage production under different levels of mechanical control of *Populus tremuloides* is presented in tables.
107. TAUSCH, ROBIN J., and PAUL T. TUELLER. 1977. Plant succession following chaining of pinyon-juniper woodlands in eastern Nevada. *J. Range Manage.* 30:44-49.  
The effect of *Pinus monophylla* and *Juniperus osteosperma* on herbaceous and shrubby cover is described (graph and equation).
108. VALLENTINE, JOHN F. 1971. Range development and improvements. 516 p. Brigham Young University Press, Provo, Utah.  
Data from numerous studies (United States and Canada) of methods (mechanical, chemical, and burning) to increase herbage production on ranges characterized by various shrub overstories are discussed.
109. WARNER, JAMES H., and K. T. HARPER. 1972. Understory characteristics related to site quality for aspen in Utah. Brigham Young Univ. Sci. Bull. Biol. Ser. 16(2), 20 p. Provo, Utah.  
Understory production and *Populus tremuloides* density are presented in tables.
110. WEST, NEIL E., ROBIN J. TAUSCH, and AGELI A. NABI. 1979. Patterns and rates of pinyon-juniper invasion and degree of suppression of understory vegetation in the Great Basin. U.S. Dep. Agric. For. Serv., Range Improve. Notes (Sept. 1979), p. 1-14. Intermt. Region, Ogden, Utah.  
Presents a linear equation for the relation of understory cover to overstory cover for a site in southwestern Utah.
111. WRIGHT, HENRY A., LEON F. NEUNSCHWANDER, and CARLTON M. BRITTON. 1979. The role and use of fire in sagebrush-grass and pinyon-juniper plant communities. A state-of-the-art review. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. INT-58, 48 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.  
Various reports are cited that show how understory production is changed by removing *Artemisia* or *Pinus-Juniperus* by fire in western United States.
112. YOUNG, JAMES A., and RAYMOND A. EVANS. 1970. Invasion of medusahead into the Great Basin. *Weed Sci.* 18:89-97.  
Cover, frequency, and constancy of herbaceous communities infested with medusahead (*Taeniatherum asperum*) under different woodland communities are given (tables). Woodland communities include low sagebrush-western juniper, big sagebrush-western juniper, and ponderosa pine.

113. YOUNG, JAMES A., and RAYMOND A. EVANS. 1976. Control of pinyon saplings with picloram or karbutilate. *J. Range Manage.* 29:144-147.

In Churchill Canyon, Nev., pinyon (*Pinus monophylla*) was controlled with herbicides. Herbage yields with and without trees are given in tabular form.

114. YOUNG, JAMES A., and RAYMOND A. EVANS. 1978. Population dynamics after wildfires in sagebrush grasslands. *J. Range Manage.* 31:283-289.

Response of understory species to burning of *Artemisia tridentata* was studied in western Nevada. Data are given in tabular and graphic forms.

## Northern

115. BASILE, JOSEPH V., and CHESTER E. JENSEN. 1971. Grazing potential on lodgepole pine clearcuts in Montana. U.S. Dep. Agric. For. Serv., Res. Pap. INT-98, 11 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

Production of understory vegetation following clearing of lodgepole pine (*Pinus contorta*) is described by multiple regression sets that identify combinations of environmental factors affecting understory vegetation production.

116. HABECK, JAMES R. 1976. Forests, fuels and fire in the Selway-Bitterroot Wilderness, Idaho. In Proc. Tall Timbers Fire Ecol. Conf. and Fire and Land Manage. Symp. p. 305-353. Tall Timbers Res. Stn., Tallahassee, Fla.

Presents tabular understory and overstory cover data for mixed conifer forests.

117. HALL, DALE O., and JAMES D. CURTIS. 1970. Planting method affects height growth of ponderosa pine in central Idaho. U.S. Dep. Agric. For. Serv., Res. Note INT-125, 8 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.

The effect of understory removal (stripped, stripped and furrowed) on survival and growth (height) of planted ponderosa pine (*Pinus ponderosa*) is described (tables).

118. IRWIN, LARRY L., and JAMES M. PEEK. 1979. Shrub production and biomass trends following five logging treatments within the cedar-hemlock zone of northern Idaho. *For. Sci.* 25:415-426.

For *Thuja plicata*, *Abies grandis*, and *Tsuga heterophylla* habitat types equations are given which predict shrub biomass using environmental and some stand characteristics. Equations for the probability of shrub occurrence are also given.

119. KLEBENOW, DONALD A. 1965. A montane forest winter deer habitat in western Montana. *J. Wildl. Manage.* 29:27-33.

Browse production on five areas of varying densities of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) in the Rattlesnake Creek Drainage, burned in 1919, is given (tables).

120. LOMMANSSON, T. 1948. Succession in sagebrush. *J. Range Manage.* 1:19-21.

The percent composition of grasses and grasslike plants, big sagebrush, and weeds, and the total vegetation cover are presented for a study area in southwestern Montana.

121. LYON, L. JACK and PETER F. STICKNEY. 1976. Early vegetal succession following large northern Rocky Mountain wildfires. In Proc. Tall Timbers Fire Ecol. Conf. and Fire and Land Manage. Symp. p. 355-375. Tall Timbers Res. Stn., Tallahassee, Fla.

Presents tabular data on overstory plant numbers and understory cover from Northern Rocky Mountain *Pinus* forests.

122. MACKIE, RICHARD J. 1970. Range ecology and relations of mule deer, elk and cattle in the Missouri River Breaks, Montana. *Wildl. Monogr.* 20, 79 p.

Tabular data on canopy coverage and frequency of occurrence for overstory and understory species within habitat types are given. The various habitat types have conifer, shrub, and herbaceous dominants.

123. MUEGGLER, WALTER F. 1965. Ecology of seral shrub communities in the cedar-hemlock zone of northern Idaho. *Ecol. Monogr.* 35:165-185.

Frequency, cover, and height are given in tabular form for understory species in relation to different amounts of *Thuja-Tsuga* disturbance.

124. PENGELLY, W. LESLIE. 1963. Timberlands and deer in the northern Rockies. *J. For.* 61:734-740.

Comparisons of ground cover and botanical composition of forage on logged and unlogged Douglas-fir (*Pseudotsuga menziesii*) forests in Idaho are presented (tables and graphs).

125. PFISTER, ROBERT D., BERNARD L. KOVALCHIK, STEPHEN F. ARNO, and RICHARD C. PRESBY. 1977. Forest habitat types of Montana. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. INT-34, 174 p.

Contains tables of overstory and understory canopy cover for 64 coniferous forest habitat types.

126. WEAVER, T., and D. DALE. 1974. *Pinus albiculis* in central Montana: environment, vegetation, and production. *Am. Midl. Nat.* 92:222-230.

Nineteen climax whitebark pine forests in the Rocky Mountains of south-central Montana were compared. Frequency of occurrence and percent cover of understory vegetation are given in tabular form for each of the forests. Forests varied in age, total cover, and basal area of the overstory species.

## Rocky Mountain

127. ALLEY, H. P., and D. W. BOHMONT. 1958. Big sagebrush control. *Univ. Wyo. Agric. Exp. Stn. Bull.* 354.

Grass cover related to *Artemisia tridentata* cover is presented graphically for Wyoming.

128. ALLEY, HAROLD P. 1956. Chemical control of big sagebrush and its effect upon production and utilization of native grass species. *Weeds* 4:164-173.

Production of native grasses associated with different levels of control (2,4-D; 2,4,5-T) of big sagebrush (*Artemisia tridentata*) is given (table) for a study area in northern Wyoming.

129. ARO, RICHARD S. 1971. Evaluation of pinyon-juniper conversion to grassland. *J. Range Manage.* 24:188-197. Forage production with and without the application of different pinyon-juniper conversion techniques (burning, dozing, and chaining) is described for public lands in Colorado, Utah, Arizona, and New Mexico.

130. BARTOS, DALE L. 1978. Modeling plant succession in aspen ecosystems. In Proc. First Int. Rangeland Cong. p. 208-211. Denver, Colo.  
Biomass of understory and overstory is simulated through time for central Rocky Mountain ecosystems.
131. BROWN, HARRY E. 1958. Gambel oak in west-central Colorado. Ecology 39:317-327.  
The occurrence, ground cover, and production of understory plants under Gambel oak (*Quercus gambelii*) overstory and in adjacent openings are given in tabular form.
132. CURRIE, PAT O. 1975. Grazing management of ponderosa pine-bunchgrass ranges of the central Rocky Mountains: the status of our knowledge. U.S. Dep. Agric. For. Serv., Res. Pap. RM-159, 24 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Two- and three-dimensional graphs illustrate the relationship between herbage yields and timber (*Pinus ponderosa*) density, degrees of grazing use, and stocking rate.
133. DAVIS, JOSEPH H., III, and CHARLES D. BONHAM. 1979. Interference of sand sagebrush canopy with needle and thread. J. Range Manage. 32:384-386.  
Effect of presence or absence of *Artemisia filifolia* on grass biomass is illustrated graphically for eastern Colorado.
134. DESPAIN, DON G. 1973. Vegetation of the Big Horn Mountains, Wyoming, in relation to substrate and climate. Ecol. Monogr. 43:329-355.  
From the base of the range of the Big Horn Mountains to near timberline, four forest and shrub types (*Picea engelmannii*-*Abies lasiocarpa*, *Pinus contorta*, *Pseudotsuga menziesii*, and *Juniperus osteosperma*) were sampled. Percent cover of the herb layer in the forest communities is shown (graphs and tables).
135. GESINK, R. W., H. P. ALLEY, and G. A. LEE. 1973. Vegetation response to chemical control of broom snakeweed on a blue grama range. J. Range Manage. 26:139-143.  
Herbage response to control (picloram and 2,4-D) of *Gutierrezia sarothrae* in southeastern Wyoming is presented graphically.
136. HOLCH, A. E. 1932. Forest vegetation in southeastern Nebraska. J. For. 30:72-74.  
A census of trees, shrubs, and vines in three forest habitats is presented in tabular form. Habitats evaluated include basswood forest, red oak forest, and bur oak forest.
137. HULL, A. C., JR., N. A. KISSINGER, JR., and W. T. VAUGHN. 1952. Chemical control of big sagebrush in Wyoming. J. Range Manage. 5:398-402.  
A table describes the relationship between grass production and sagebrush (*Artemisia tridentata*) kill (2,4-D; 2,4,5-T).
138. JEFFERIES, NED W. 1965. Herbage production on a Gambel oak range in southwestern Colorado. J. Range Manage. 18:212-213.  
Herbage yields under an overstory of Gambel oak (*Quercus gambelii*) and in adjacent openings are given (table) for a study at the San Juan Experimental Station.
139. JOHNSON, W. M. 1953. Effect of grazing intensity upon vegetation and cattle gains on ponderosa pine-bunchgrass ranges of the front range of Colorado. U.S. Dep. Agric. Circ. 929, 36 p. Washington, D.C.  
Herbage ground cover in grassland park, sparse ponderosa pine (*Pinus ponderosa*) overstory, dense ponderosa pine overstory, and abandoned field situations is presented in tabular form for a study on the Manitou Experimental Forest. Also includes a table of herbage production in grassland and open timber situations.
140. JOHNSON, W. M. 1969. Life expectancy of a sagebrush control in central Wyoming. J. Range Manage. 22:177-182.  
Herbage production is given for areas with and without chemical control of *Artemisia tridentata*.
141. KISSINGER, N. A., JR., A. C. HULL, JR., and W. T. VAUGHN. 1952. Chemical control of big sagebrush in central Wyoming. U.S. Dep. Agric. For. Serv., Stn. Pap. 9, 14 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Grass production is compared (table) with percent big sagebrush (*Artemisia tridentata*) overstory killed (2,4-D; 2,4,5-T).
142. KISSINGER, N. A., JR., and RICHARD M. HURD. 1953. Control big sagebrush with chemicals and grow more grass. U.S. Dep. Agric. For. Serv., Stn. Pap. RM-11, 23 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Grass production under sprayed (2,4-D; 2,4,5-T) and unsprayed stands of big sagebrush (*Artemisia tridentata*) overstory is described for a study area in Wyoming.
143. KRANZ, JEREMIAH J., and RAYMOND L. LINDER. 1973. Value of Black Hills forest communities to deer and cattle. J. Range Manage. 26:263-265.  
In South Dakota, studies were conducted of the relation of understory production to basal area of aspen (*Populus tremuloides*) and ponderosa pine (*Pinus ponderosa*). Data are presented graphically.
144. KRENZ, RONALD D. 1962. Costs and returns from spraying sagebrush with 2,4-D. Univ. Wyo., Laramie, Agric. Exp. Stn. Bull. 390, 31 p.  
Values are tabulated for forage production with different degrees of chemical control of sagebrush in Wyoming.
145. KUFELD, ROLAND C. 1977. Improving Gambel oak ranges for elk and mule deer by spraying with 2,4,5-T. J. Range Manage. 30:53-57.  
In northwestern Colorado, *Quercus gambelii* was removed by chemicals. Understory species abundance with and without spraying is presented in tabular form.
146. LEAF, CHARLES F. 1975. Watershed management in the central and southern Rocky Mountains: a summary of the status of our knowledge by vegetation types. U.S. Dep. Agric. For. Serv. Res. Pap. RM-142, 28 p. Fort Collins, Colo.  
Effects of *Quercus gambelii* on herbage production are discussed (tables).
148. MOINAT, A. D. 1956. Comparative yields of herbage from oak scrub and interspersed grassland in Colorado. Ecology 37:852-854.  
Herbage production associated with grass parks and adjacent Gambel oak (*Quercus gambelii*) is presented in tabular form.
149. MOIR, WILLIAM H. 1969. The lodgepole pine zone in Colorado. Am. Midl. Nat. 81:87-98.  
*Pinus contorta* density and cover as well as understory cover and presence are presented in table form.

150. PASE, CHARLES P. 1958. Herbage production and composition under immature ponderosa pine stands in the Black Hills. J. Range Manage. 11:238-243.  
Herbage production under varying ponderosa pine (*Pinus ponderosa*) overstory densities is described in tables and graphs. Also, logarithmic prediction equations relating herbage production to different expressions of ponderosa pine density are given.
151. PASE, CHARLES P., and RICHARD M. HURD. 1957. Understory vegetation as related to basal area, crown cover, and litter produced by immature ponderosa pine stands in the Black Hills. Proc. Soc. Am. For. 1957:156-158.  
Contains a logarithmic predicting equation describing herbage yields as a function of the density of ponderosa pine (*Pinus ponderosa*) overstory. Also, the curvilinear relationship illustrating the equation is given.
152. PAULSEN, HAROLD A., JR. 1969. Forage values of a mountain grassland-aspen range in western Colorado. J. Range Manage. 22:102-107.  
Herbage production on grassland and *Populus tremuloides* ranges is given in tabular form.
153. PAULSEN, HAROLD A., JR., and JOHN C. MILLER. 1968. Control of Parry rabbitbrush on mountain grasslands of western Colorado. J. Range Manage. 21:175-177.  
Grass and forb production under Parry rabbitbrush (*Chrysothamnus parryi*) stands treated with herbicides (2,4-D, tordon) and under control stands is given in tabular form.
154. POND, FLOYD W., and DIXIE R. SMITH. 1971. Ecology and management of subalpine ranges on the Big Horn Mountains of Wyoming. Univ. Wyo., Laramie, Agric. Exp. Stn. Res. J. 53, 25 p.  
A literature review, including a discussion of forage production as affected by control (herbicides) of big sagebrush (*Artemisia tridentata*) overstory, is presented.
155. REGELIN, WAYNE L., and OLAF C. WALLMO. 1978. Duration of deer forage benefits after clearcut logging of subalpine forest in Colorado. U.S. Dep. Agric. For. Serv., Res. Note RM-356, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Comparisons of understory production for uncut conditions and strip cuts in spruce, fir, and pine forests are given in tabular form.
- ELBERT H. 1965. Forage production in ponderosa forests. Proc. Soc. Am. For. 1964:61-64.  
Review, including a summary of forage values and the effect of overstory on herbage production, is presented for ponderosa pine forest type in the West.
- SON, KEITH E., and CHARLES E. BOLT. 1977. Forage values for Black Hills forest owners: timber, forage, or range. Rangeman's J. 4:13-15.  
Effects of thinning of *Pinus ponderosa* affected on understory characteristics. Data are presented in tabular form.
- SON, KEITH E., and JEREMIAH J. KRANZ. Understory production not predictable from aspen area or density. U.S. Dep. Agric. For. Serv., Res. Note RM-314, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Comparisons of understory production under quaking aspen (*Populus tremuloides*) basal area levels ranging from 42 to 120 ft<sup>2</sup> are given for the Black Hills and Bear Lodge Mountains.
159. SEVERSON, KEITH E., and JOHN F. THILENIUS. 1976. Classification of quaking aspen stands in the Black Hills and Bear Lodge Mountains. U.S. Dep. Agric. For. Serv., Res. Pap. RM-166, 24 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Frequency, composition, productivity, and nutritive values of the understory under different *Populus tremuloides* canopy structures are presented for 28 stands in western South Dakota and northeastern Wyoming.
160. SHOWN, L. M., R. F. MILLER, and F. A. BRANSON. 1969. Sagebrush conversion to grassland as affected by precipitation, soil, and cultural practices. J. Range Manage. 22:303-311.  
The yield of crested wheatgrass (*Agropyron desertorum*) is presented (table) for treated (plowing) and adjacent untreated areas of big sagebrush (*Artemisia tridentata*) in the West.
161. SMITH, DWIGHT R. 1967. Effects of cattle grazing on a ponderosa pine-bunchgrass range in Colorado. U.S. Dep. Agric. Tech. Bull. 1371, 60 p. Washington, D.C.  
A graph describes herbage production under dense timber, open timber, and grassland situations on the Manitou Experimental Forest. The overstory is dominated by ponderosa pine (*Pinus ponderosa*).
162. TAYLOR, DALE L. 1973. Some ecological implications of forest fire control in Yellowstone National Park, Wyoming. Ecology 54:1394-1396.  
Seven areas of *Pinus contorta* in Yellowstone National Park were selected to study changes in plant and animal diversity 1 to 300 years following fire. The number of species of herbs, shrubs, and trees for each area is given (tables).
163. THILENIUS, JOHN F., and GARY R. BROWN. 1974. Long-term effects of chemical control of big sagebrush. J. Range Manage. 27:223-224.  
Effects of chemical control of *Artemisia tridentata* on herbage production in the Big Horn Mountains of Wyoming is discussed.
164. THOMPSON, WESLEY W., and F. ROBERT GARTNER. 1971. Native forage response to clearing low quality ponderosa pine. J. Range Manage. 24:272-277.  
Forage production and species composition under ponderosa pine (*Pinus ponderosa*) overstory and on sites where ponderosa pine was removed (cutting) are described (tables) for different aspects on a study area in the Black Hills of South Dakota.
165. TURNER, GEORGE T. 1969. Responses of mountain grassland vegetation to gopher control, reduced grazing, and herbicide. J. Range Manage. 22:377-383.  
Production of grasses, forbs, and shrubs is given (table) for sprayed (2,4-D) and unsprayed areas supporting silver sagebrush (*Artemisia cana*) in western Colorado.
166. TURNER, GEORGE T., and HAROLD A. PAULSEN, JR. 1976. Management of mountain grasslands in the central Rockies: the status of our knowledge. U.S. Dep. Agric. For. Serv., Res. Pap. RM-161, 24 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
The effects of grazing treatments and various harvesting systems upon understory species on the spruce-fir (*Picea* spp. and *Abies* spp.) forests in Wyoming, Colorado, Arizona, and New Mexico are discussed (tables and graph).

167. WALLMO, OLAF C., WAYNE L. REGELIN, and DONALD W. REICHERT. 1972. Forage use by mule deer relative to logging in Colorado. *J. Wildl. Manage.* 36:1025-1033.

On the Fraser Experimental Forest, lodgepole pine (*Pinus contorta*) and spruce-fir (*Picea engelmannii-Abies lasiocarpa*) were logged and unlogged in alternate strips. The mean percentage frequencies of occurrence of herbage produced on the treated and untreated strips are compared (table).

168. WARD, A. LORIN. 1973. Sagebrush control with herbicide has little effect on elk calving behavior. U.S. Dep. Agric. For. Serv., Res. Note RM-240, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

Changes in vegetation composition before and after spraying big sagebrush (*Artemisia tridentata*) on the Bighorn National Forest (Wyoming) with 2,4-D herbicide are given (table).

169. WILBERT, DON E. 1963. Some effects of chemical sagebrush control on elk distribution. *J. Range Manage.* 16:74-78. Tables describing grass, forbs, and brush production under sprayed (2,4-D) and unsprayed stands of big sagebrush (*Artemisia tridentata*) are presented for the Teton National Forest in Wyoming.

## Southwestern

170. ARNOLD, JOSEPH F. 1950. Changes in ponderosa pine bunchgrass ranges in northern Arizona resulting from pine regeneration and grazing. *J. For.* 48:118-126.

Tables and graphs describe relationships between herbaceous density and percent of ground covered by ponderosa pine overstory.

171. ARNOLD, JOSEPH F. 1953. Effect of heavy selection logging on herbaceous vegetation in a ponderosa pine forest in northern Arizona. *J. For.* 51:101-105.

Herbaceous density is presented (tables) before and after logging, and in terms of surface disturbances, slash accumulation, and change in canopy after logging.

172. ARNOLD, JOSEPH F. 1956. Conversion of poor and non-commercial pine stands to grasslands. *In Recovering rainfall.* p. 90-99. Dep. Agric. Econ., Univ. Ariz., Tucson.

Herbage yield before and after conversion (cutting, dozing, chopping) of ponderosa pine overstory is presented (table) for Arizona.

173. ARNOLD, JOSEPH F. 1956. Economic aspects of converting juniper and pinyon to grasslands. *In Recovering rainfall.* p. 67-89. Dep. Agric. Econ., Univ. Ariz., Tucson.

Herbage yield before and after conversion (dozing, chopping) of juniper and pinyon woodland overstories is presented (tables) for Arizona.

174. ARNOLD, JOSEPH F. 1964. Zonation of understory vegetation around a juniper tree. *J. Range Manage.* 17:41-42.

Herbage production is presented (table) by zones around a one-seed juniper (*Juniperus monosperma*) tree in a pinyon-juniper woodland of east-central Arizona.

175. ARNOLD, JOSEPH F., DONALD A. JAMESON, and ELBERT H. REID. 1964. The pinyon-juniper type of Arizona: effects of grazing, fire and tree control. U.S. Dep. Agric. Prod. Res. Rep. 84, 28 p. Washington, D.C.

Relationships between herbage cover and yield and percent canopy intercept of pinyon and juniper overstory are graphically illustrated. Overstory is dominated by Utah (*Juniperus osteosperma*), one-seed (*J. monosperma*), and alligator (*J. deppeana*) juniper.

176. ARNOLD, JOSEPH F., and W. L. SCHROEDER. 1955. Juniper control increases forage production on the Fort Apache Indian Reservation. U.S. Dep. Agric. For. Serv., Stn. Pap. 18, 35 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

Tables and bar graphs describing understory yields before and after removal of one-seed juniper (*Juniperus monosperma*), other juniper, and pinyon (*Pinus edulis*) are presented for a study area in east-central Arizona. Also, relationships between herbage yields and overstory density are given.

177. BAKER, MALCHUS B., JR., and HARRY E. BROWN. 1974. Multiple use evaluations on ponderosa pine forest land. *Annu. Ariz. Watershed Symp. Proc.* 18:18-25.

Following thinning and clearing ponderosa pine (*Pinus ponderosa*) on the Beaver Creek Watershed, production of herbaceous and shrubby plants increased. The relationships between overstory removal and herbage production are graphically illustrated and described.

178. BISWELL, H. H. 1956. Manipulating plant cover on the Salt River watershed to increase water yield. *In Recovering rainfall.* p. 115-136. Dep. Agric. Econ., Univ. Ariz., Tucson.

Changes in forage production associated with different vegetation management practices are discussed for various overstory types (pinyon-juniper, ponderosa pine, aspen, spruce-fir, chaparral, and stream-course) in Arizona.

179. BRANSON, F. A., REUBEN F. MILLER, AND I. S. McQUEEN. 1976. Moisture relationships in twelve northern desert shrub communities near Grand Junction, Colorado. *Ecology* 57:1104-1124.

182. BROWN, HARRY E., MALCHUS B. BAKER, JR., JAMES J. ROGERS, and others. 1974. Opportunities for increasing water yields and other multiple use values on ponderosa pine forest lands. U.S. Dep. Agric. For. Serv., Res. Pap. RM-129, 36 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Data showing herbage production under different basal areas of *Pinus ponderosa* on the Beaver Creek watershed, Arizona, are listed in tabular form.
183. CABLE, DWIGHT R. 1957. Recovery of chaparral following burning and seeding in central Arizona. U.S. Dep. Agric. For. Serv., Res. Note 28, 6 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Tables describing perennial grass basal density, estimated by line intercept, and shrub live oak (*Quercus turbinella*) crown density are given for a study area in the Pinal Mountains.
184. CABLE, DWIGHT R. 1967. Fire effects on semi-desert grasses and shrubs. J. Range Manage. 20:170-176.  
On the Santa Rita Experimental Range, Ariz., velvet mesquite (*Prosopis juliflora*) was burned in one area and not burned on another area. Annual grass production before and after treatment was compared (graphs).
185. CABLE, DWIGHT R. 1969. Competition in the semi-desert grass-shrub type as influenced by root systems, growth habits, and soil moisture extraction. Ecology 50:28-38.  
Gives the relationship between production of perennial grass and burroweed (*Aplopappus tenuisectus*) crown cover (graph) for a study area on the Santa Rita Experimental Range in southern Arizona.
186. CABLE, DWIGHT R. 1971. Lehmann lovegrass on the Santa Rita Experimental Range, 1937-1968. J. Range Manage. 24:17-21.  
The relation of native grasses and Lehmann lovegrass (*Eragrostis lehmanniana*) production to velvet mesquite (*Prosopis juliflora*) density and removal (2,4,5-T) is described for a study site in southern Arizona.
187. CABLE, DWIGHT R. 1972. Fourwing saltbush revegetation trials in southern Arizona. J. Range Manage. 25:150-153.  
Effect of velvet mesquite (*Prosopis juliflora*), creosotebush (*Larrea tridentata*), and burroweed (*Aplopappus tenuisectus*) on survival of fourwing saltbush (*Atriplex canescens*) located on the Santa Rita Experimental Range is discussed. Creosotebush and mesquite-burroweed were sprayed with 4-amino-3,5,6 trichloropiclonic acid, grubbed, or untreated. Results are graphically illustrated.
188. CABLE, DWIGHT R. 1975. Influence of precipitation on perennial grass production in the semidesert Southwest. Ecology 56:981-986.  
The amount of herbage produced (influenced by rainfall) on pastures on the Santa Rita Experimental Range having velvet mesquite (*Prosopis juliflora*) present and absent is graphically illustrated.
189. CABLE, DWIGHT R. 1975. Range management in the chaparral type and its ecological basis: the status of our knowledge. U.S. Dep. Agric. For. Serv., Res. Pap. RM-155, 30 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Production of grasses and forbs on Mingus Mountain, Ariz., during 5 consecutive years following burning of shrub live oak (*Quercus turbinella*) is tabulated.
190. CABLE, DWIGHT R. 1976. Twenty years of changes in grass production following mesquite control and reseedling. J. Range Manage. 29:286-289  
In southern Arizona, mesquite (*Prosopis juliflora*) was controlled with 2,4,5-T. Herbage production with and without control is given in graphic form.
191. CABLE, DWIGHT R., and S. CLARK MARTIN. 1964. Forage production and stocking rates on southern Arizona ranges can be improved. U.S. Dep. Agric. For. Serv., Res. Note RM-30, 11 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Basal area and herbage production of annual and perennial grass under dead or alive velvet mesquite (*Prosopis juliflora*) on the Santa Rita Experimental Range are tabulated.
192. CABLE, DWIGHT R., and S. CLARK MARTIN. 1975. Vegetation responses to grazing, rainfall, site condition, and mesquite control on semidesert range. U.S. Dep. Agric. For. Serv., Res. Pap. RM-149, 24 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Graphically illustrated is yearly grass production of sprayed (diesel oil) and unsprayed velvet mesquite (*Prosopis juliflora*) pastures along the Santa Rita Mountains, Ariz.
193. CABLE, DWIGHT R., and FRED H. TSCHIRLEY. 1961. Responses of native and introduced grasses following aerial spraying of velvet mesquite in southern Arizona. J. Range Manage. 14:155-159.  
Tables describing grass production under sprayed (2,4,5-T) and unsprayed stands of velvet mesquite (*Prosopis juliflora*) are presented for the Santa Rita Experimental Range.
194. CLARY, WARREN P. 1969. Increased sampling precision for some herbage variables through knowledge of the timber overstory. J. Range Manage. 22:200-201.  
Relationships of herbage production, perennial grass production, and forage consumed to percent ponderosa pine (*Pinus ponderosa*) crown cover in a study in Arizona are logarithmic.
195. CLARY, WARREN P. 1970. The relationship of herbage production on Springerville soils to Utah juniper overstory and precipitation. p. 69. In Abstr. of Pap., 23rd Annu. Meet., Am. Soc. Range Manage., Denver, Colo.  
Herbage and perennial grass yields associated with intact Utah juniper overstory and overstory removed by cabling are described for a study area in north-central Arizona.
196. CLARY, WARREN P. 1971. Effects of Utah juniper removal on herbage yields from Springerville soils. J. Range Manage. 24:373-378.  
Relationships between total understory (linear) and perennial grasses (curvilinear), and crown cover of Utah juniper (*Juniperus osteosperma*) and pinyon (*Pinus edulis*) overstory are graphically illustrated for a study area in north-central Arizona. Also, herbage yields with and without mechanical removal of overstory (table), and perennial grass production trends through time (graph) are presented.
197. CLARY, WARREN P. 1974. Pinyon-juniper control: does it pay? Annu. Ariz. Watershed Symp Proc. 18:26-29.  
Results from Arizona studies are presented graphically showing relationships between herbage, trees, rainfall, and soils. Primary tree species are Utah juniper (*Juniperus osteosperma*) and alligator juniper (*J. deppeana*).
198. CLARY, WARREN P. 1974. Response of herbaceous vegetation to felling of alligator juniper. J. Range Manage. 27:387-389.  
Herbage production with and without *Juniperus deppeana* overstories is shown by graph and table for central Arizona.



199. CLARY, WARREN P. 1975. Multiple use effects of manipulating pinyon-juniper. p. 459-477. In Watershed Manage. Symp., Am. Soc. Civil Eng., Irrig. and Drain. Div. [Logan, Utah, Aug. 11-13].  
Relationships between herbage production, tree basal area, precipitation, and soils are presented graphically. Dominant overstory species in Arizona are *Juniperus osteosperma* and *J. deppeana*.
200. CLARY, WARREN P. 1975. Range management and its ecological basis in the ponderosa pine type of Arizona: the status of our knowledge. U.S. Dep. Agric. For. Serv., Res. Pap. RM-158, 35 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
The effect of varying densities of ponderosa pine (*Pinus ponderosa*) upon the amount of herbage produced on the Wild Bill Range and Beaver Creek watershed is graphically illustrated.
201. CLARY, WARREN P. 1978. Arizona fescue mountain rangelands. p. 205-207. In Proc. First Int. Rangeland Cong. Denver, Colo.  
Relationship of herbage production to tree basal area is presented graphically for *Pinus ponderosa* overstories. These forested ranges are in Arizona, Colorado, and New Mexico.
202. CLARY, WARREN P. 1978. Producer-consumer biomass in Arizona ponderosa pine. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-56, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
An equation describes the relationship between herbage production and *Pinus ponderosa* basal area for the Coconino Plateau of Arizona.
203. CLARY, WARREN P., MALCHUS B. BAKER, JR., PAUL F. O'CONNELL, and others. 1974. Effects of pinyon-juniper removal on natural resource products and uses in Arizona. U.S. Dep. Agric. For. Serv., Res. Pap. RM-128, 28 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Tabular data, graphics, and equations are used to show the relation of herbage production to Utah juniper (*Juniperus osteosperma*) and alligator juniper (*J. deppeana*) on the Beaver Creek watershed.
204. CLARY, WARREN P., and PETER F. FFOLLIOTT. 1966. Differences in herbage-timber relationships between thinned and unthinned ponderosa pine stands. U.S. Dep. Agric. For. Serv., Res. Note RM-74, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Herbage production under thinned and unthinned ponderosa pine (*Pinus ponderosa*) stands is compared by logarithmic equations for a study area in north-central Arizona.
205. CLARY, WARREN P., PETER F. FFOLLIOTT, and DONALD A. JAMESON. 1968. Relationship of different forest layers to herbage production. U.S. Dep. Agric. For. Serv., Res. Note RM-123, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
In north-central Arizona, logarithmic equations describe relationships between herbage production and individual layers and between herbage production and total depth of ponderosa pine (*Pinus ponderosa*) forest floor.
206. CLARY, WARREN P., PETER F. FFOLLIOTT, and ALMER D. ZANDER. 1966. Grouping sites by soil management areas and topography. U.S. Dep. Agric. For. Serv., Res. Note RM-60, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Relationships between herbage production and ponderosa pine (*Pinus ponderosa*) overstory density for different productivity strata are graphically illustrated for a study area in north-central Arizona.
207. CLARY, WARREN P., and HAROLD E. GRELEN. 1978. Comparison of beef gain potentials on cool semi-arid and subtropical pine forest ranges. p. 600-602. In Proc. First Int. Rangeland Cong. Denver, Colo.  
Relationships of forage value index and tree basal area are given for overstories of *Pinus ponderosa* in Arizona and *P. palustris*-*P. elliotii* in Louisiana.
208. CLARY, WARREN P., WILLIAM H. KRUSE, and FREDERIC R. LARSON. 1975. Cattle grazing and wood production with different basal areas of ponderosa pine. J. Range Manage. 28:434-437.  
Tabular data describe understory production relative to *Pinus ponderosa* density levels in northern Arizona.
209. CLARY, WARREN P., and FREDERIC R. LARSON. 1971. Elk and deer use are related to food sources in Arizona ponderosa pine. U.S. Dep. Agric. For. Serv., Res. Note RM-202, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Herbage production associated with alligator juniper (*Juniperus deppeana*) and ponderosa pine (*Pinus ponderosa*) overstories is discussed.
210. CLARY, WARREN P., and DOUGLAS C. MORRISON. 1973. Large alligator junipers benefit early spring forage. J. Range Manage. 26:70-71.  
In Arizona, a study was made of the effect of mature *Juniperus deppeana* on early forage. Data are presented in tabular form.
211. COOPER, CHARLES F. 1960. Production of native and introduced grasses in the ponderosa pine region of Arizona. J. Range Manage. 13:214-215.  
A linear equation describing a relationship between grass production and percent crown cover of ponderosa pine overstory is given for a study area on the San Carlos Indian Reservation in east-central Arizona.
212. DWYER, DON D., and REX D. PIEPER. 1967. Fire effects on blue grama-pinyon-juniper rangeland in New Mexico. J. Range Manage. 20:359-362.  
Production of grasses and forbs is described (table) for burned and unburned pinyon-juniper woodlands in south-central New Mexico. Pinyon (*Pinus edulis*) and one-seed juniper (*Juniperus monosperma*) are dominant overstory species.
213. FFOLLIOTT, PETER F., and WARREN P. CLARY. 1974. Predicting herbage production from forest growth in Arizona ponderosa pine. Prog. Agric. Ariz. 26(3):3-5.  
Equations and graphics describe relationships between herbage production and timber (*Pinus ponderosa*) production.
214. FFOLLIOTT, PETER F., and WARREN P. CLARY. 1975. Differences in herbage-timber relationships on sedimentary and igneous soils in Arizona ponderosa pine stands. Prog. Agric. Ariz. 27(3):6-7.  
Several relationships between herbage production and *Pinus ponderosa* on the Coconino National Forest are illustrated graphically. Effect of soils, grazing, and tree reproduction are discussed.



215. FFOLLIOTT, PETER F., WARREN P. CLARY, and FRED R. LARSON. 1976. Fire scene 11 years after. *Prog. Agric. Ariz.* 28(1):12-13.  
The effects of prescribed burning of ponderosa pine, located on the Coconino National Forest, were studied. Herbage production for several timber densities is discussed.
216. FFOLLIOTT, PETER F., WARREN P. CLARY, and FREDERIC R. LARSON. 1977. Effects of prescribed fire in an Arizona ponderosa pine forest. U.S. Dep. Agric. For. Serv., Res. Note RM-336, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Describes changes in herbage production 11 years after prescribed fire was used to thin two *Pinus ponderosa* stands.
217. FFOLLIOTT, PETER F., and DAVID B. THORUD. 1975. Water yield improvement by vegetation management: focus on Arizona. Univ. Ariz., School of Renew. Nat. Resour. 1,094 p. [Available from Natl. Tech. Inf. Serv. as PB 246 005/AS.]  
Herbage production before and after various treatments (cabling, felling, thinning, herbicide, and fire) are illustrated (graphs and tables) for aspen (*Populus tremuloides*), ponderosa pine (*Pinus ponderosa*), pinyon-juniper (*Juniperus spp.* and *Pinus spp.*), and oak (*Quercus spp.*) overstories in several Arizona study areas.
218. FFOLLIOTT, PETER F., and DAVID THORUD. 1977. Water resources and multiple-use forestry in the Southwest. *J. For.* 75:469-472.  
Forage production with presence and absence of the overstory is given for forested and chaparral zones in Arizona.
219. FFOLLIOTT, PETER F., and DAVID P. WORLEY. 1965. An inventory system for multiple use evaluations. U.S. Dep. Agric. For. Serv., Res. Pap. RM-17, 15 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
A localized predicting equation describing herbage production as a function of ponderosa pine overstory density is logarithmic for a study area in north-central Arizona.
220. GAINES, EDWARD M., HARRY R. KALLANDER, and JOE A. WAGNER. 1958. Controlled burning in southwestern ponderosa pine: results from the Blue Mountain plots, Fort Apache Indian Reservation. *J. For.* 56:323-327.  
Grass density before and after controlled burning of ponderosa pine overstory is described (tables) for a study area in eastern Arizona.
221. GLENDENING, G. E., C. P. PASE, and P. INGEBO. 1961. Preliminary hydrologic effects of wildfire in chaparral. *Annu. Ariz. Watershed Symp. Proc.* 5:12-15.  
Recovery of shrubs, forbs, and grasses following burning of chaparral overstory, and under different cultural treatments (seeding, seeding and spraying with 2,4,5-T, control) is described (table) for a study area in central Arizona.
222. HIBBERT, ALDEN R. 1971. Increases in streamflow after converting to grass. *Water Resour. Res.* 7:71-80.  
Shrub cover and herbaceous production preceding and following a wildfire in chaparral are graphically illustrated for an area in central Arizona. Shrub live oak (*Quercus turbinella*) and birch-leaf mountain mahogany (*Cercocarpus betuloides*) are the dominant species in the overstory.
223. HIBBERT, ALDEN R., EDWIN A. DAVIS, and DAVID G. SCHOLL. 1974. Chaparral conversion potential in Arizona, part I: water yield response and effects on other resources. U.S. Dep. Agric. For. Serv., Res. Pap. RM-126, 36 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
On the Three Bar Wildlife Area in Arizona, chaparral brush (*Quercus turbinella*, *Q. chrysolepis*, *Q. emoryi*, *Cercocarpus betuloides*, *C. montanus*, *Arctostaphylos pungens*, *A. pringlei*, *Garry wrightii*, *G. flavescens*, *Ceanothus greggii*, *Rhus ovata*, *R. trilobata*, *Rhamnus crocea*, and *Eriodictyon angustifolium*) burned by wildfire, was allowed to recover or was sprayed with herbicide (2,4-D, 2,4,5-T, and silvex). Herbage production on the two treatment areas for 6 consecutive years is given (graph).
224. HIBBERT, ALDEN R., and PAUL A. INGEBO. 1971. Chaparral treatment effects on streamflow. *Annu. Ariz. Watershed Symp. Proc.* 15:25-34.  
Herbaceous production before and after conversion (burning, herbicide) of chaparral overstory is discussed for a study area in central Arizona.
225. HUNGERFORD, C. R. 1970. Response of Kaibab mule deer to management of summer range. *J. Wildl. Manage.* 34:852-862.  
The proportion of ground covered with plants associated with different forest types changed by seeding, logging, and fire is described (graphs) for a study area in northern Arizona. Forest types include ponderosa pine (*Pinus ponderosa*) and mixed conifer-aspen (*Populus tremuloides*).
226. JAMESON, DONALD A. 1962. Effects of burning on a galleta-black grama range invaded by juniper. *Ecology* 43:760-763.  
The production of grasses is given (table) for burned and unburned one-seed juniper (*Juniperus monosperma*) forest stands for a study area in north-central Arizona.
227. JAMESON, DONALD A. 1966. Competition in a blue grama-broom snakeweed-actinea community and responses to selective herbicides. *J. Range Manage.* 19:121-124.  
A table of correlation coefficients is given to illustrate the association among plant yields, including perennial grasses, broom snakeweed (*Gutierrezia sarothrae*), and Cooper actinea (*Hymenoxys cooperi*), on a study area in north-central Arizona.
228. JAMESON, DONALD A. 1966. Pinyon-juniper litter reduces growth of blue grama. *J. Range Manage.* 19:214-217.  
Pinyon (*Pinus spp.*) and juniper (*Juniperus spp.*) litter is reported to be the major overstory factor associated with the reduction of blue grama (*Bouteloua gracilis*) on a study area in north-central Arizona.
229. JAMESON, DONALD A. 1967. The relationship of tree overstory and herbaceous understory vegetation. *J. Range Manage.* 20:247-249.  
The use of a 5-parameter transition sigmoid growth curve to express the relationship between herbaceous understory and tree overstory is described and illustrated with data from north-central Arizona. Overstories considered are pinyon (*Pinus edulis*), juniper (*Juniperus spp.*), and ponderosa pine (*P. ponderosa*).

230. JAMESON, DONALD A. 1970. Juniper root competition reduces basal area of blue grama. *J. Range Manage.* 23:217-218.
- A table of blue grama (*Bouteloua gracilis*) basal area with and without one-seed juniper (*Juniperus monosperma*) root competition is presented for a study area in northern Arizona.
231. JAMESON, DONALD A. 1971. Optimum stand selection for juniper control on southwestern woodland ranges. *J. Range Manage.* 24:94-99.
- Equations describe relationships between herbage production and pinyon-juniper (*Pinus edulis*, *P. monophylla*, and *Juniperus* spp.) overstory with different grass growth forms and soils. The equation model used is a 5-parameter transition sigmoid growth curve.
232. JAMESON, DONALD A., and J. D. DODD. 1969. Herbage production differs with soil on the pinyon-juniper type of Arizona. U.S. Dep. Agric. For. Serv., Res. Note RM-131, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Herbage production associated with different soil series and pinyon-juniper overstory densities is given in tabular form.
233. JOHNSON, THOMAS N., JR. 1962. One-seed juniper invasion of northern Arizona grasslands. *Ecol. Monogr.* 32:187-207.
- Distribution of herbaceous vegetation around individual one-seed juniper (*Juniperus monosperma*) trees is graphically illustrated and detailed in tables.
234. JORDAN, GILBERT L., and MICHAEL L. MAYNARD. 1970. The San Simon watershed: revegetation. *Prog. Agric. Ariz.* 22(3):4-7.
- The production of Lehmann lovegrass (*Eragrostis lehmanniana*) associated with different seedbed preparations (root plowed, disked plowed, or chained) is presented (table) for creosotebush (*Larrea tridentata*), mesquite (*Prosopis juliflora*), and mixed creosotebush-mesquite communities in southeastern Arizona.
235. KINCAID, D. R., G. A. HOLT, P. D. DALTON, and J. S. TIXIER. 1959. The spread of Lehmann lovegrass as affected by mesquite and native perennial grasses. *Ecology* 40:738-742.
- In Arizona, the effects of competition among Lehmann lovegrass (*Eragrostis lehmanniana*), perennial grasses, and velvet mesquite (*Prosopis juliflora*) overstory are graphically illustrated.
236. KRUSE, WILLIAM H. 1972. Effects of wildfire on elk and deer use of a ponderosa pine forest. U.S. Dep. Agric. For. Serv., Res. Note RM-226, 3 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Changes in production of grasses, forbs, and shrubs before and after burning of ponderosa pine (*Pinus ponderosa*) on the Wild Bill Study Area, Ariz., is given (table).
237. KRUSE, WILLIAM H., RUSSELL P. BALDA, MICHAEL J. SIMONO, and others. 1979. Community development in two adjacent pinyon-juniper eradication areas twenty-five years after treatment. *J. Environ. Manage.* 8:237-247.
- Tabular data are given for herbage production in treated and untreated *Juniperus* stands in central Arizona.
238. KUNDAELI, JOHN N., and HUDSON G. REYNOLDS. 1972. Desert cottontail use of natural and modified pinyon-juniper woodland. *J. Range Manage.* 25:116-118.
- Shrub density and herbage production are compared to overstory tree density. Data are from Ft. Bayard Experimental Forest, New Mex. Overstory is primarily *Pinus edulis* and *Juniperus* spp. Data are presented in table form.
239. LARSON, M. M. and GILBERT H. SCHUBERT. 1969. Root competition between ponderosa pine seedlings and grasses. U.S. Dep. Agric. For. Serv., Res. Pap. RM-54, 12 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Relationships between different perennial grass cover types and ponderosa pine (*Pinus ponderosa*) seedling growth are given (tables and graphs) for the Fort Valley Experimental Forest in north-central Arizona.
240. LOWE, PHILIP O., PETER F. FFOLLIOTT, JOHN H. DIETERICH, and DAVID R. PATTON. 1978. Determining potential wildlife benefits from wildfires in Arizona ponderosa pine forests. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-52, 12 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Basal area of grasses and forbs on burned areas 1, 3, 7, and 20 years old and on a control area in *Pinus ponderosa* forests in north-central Arizona is graphically compared.
241. MARTIN, S. CLARK. 1963. Grow more grass! by controlling mesquite. *Prog. Agric. Ariz.* 15(4):15-16.
- Relation of grass produced per inch of summer rainfall received at the Santa Rita Experimental Range in southern Arizona to the number of mesquite trees on the site is graphically illustrated.
242. MARTIN, S. CLARK. 1966. The Santa Rita Experimental Range. U.S. Dep. Agric. For. Serv., Res. Pap. RM-22, 24 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

246. MARTIN, S. CLARK, and DWIGHT R. CABLE. 1974. Managing semidesert grass-shrub ranges: vegetation responses to precipitation, grazing, soil texture, and mesquite control. U.S. Dep. Agric. Tech. Bull. 1480, 45 p. Washington, D.C.  
Velvet mesquite (*Prosopis juliflora*) on the Santa Rita Experimental Range in Arizona were sprayed with diesel oil. Herbage production for treated and untreated pastures is given (table and graph).
247. MARTIN, S. CLARK, JOHN L. THAMES, and ERNEST B. FISH. 1974. Changes in cactus numbers and herbage production after chaining and mesquite control. Prog. Agric. Ariz. 26(6):3-6.  
On the Santa Rita Experimental Range, Ariz., cacti (*Opuntia fulgida*, *O. spinosior*, *O. versicolor*, *O. engelmannii*, and *Ferocactus wislizenii*) were chained and mesquite (*Prosopis juliflora*) were treated with diesel oil. Herbage production and percent composition of perennial grasses on the treated and untreated areas are shown in tables.
248. McCULLOCH, CLAY Y. 1966. Cliffrose browse yield on bulldozed pinyon-juniper areas in northern Arizona. J. Range Manage. 19:373-374.  
Production of cliffrose (*Cowanlia mexicana*) browse associated with bulldozed and unbulldozed stands of pinyon-juniper (*Pinus edulis*-*Juniperus* spp.) overstory is presented in tabular form.
249. McCULLOCH, CLAY Y. 1969. Some effects of wildfire on deer habitat in pinyon-juniper woodland. J. Wildl. Manage. 33:778-784.  
Herbaceous forage available 13 to 15 years after a wildfire is given (table) for burned and unburned pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) woodland type on the Hualapai Indian Reservation in northern Arizona.
250. NEFF, DON J. 1974. Forage preferences of trained mule deer on the Beaver Creek watersheds. Ariz. Game and Fish Dep. Spec. Rep. 4, 61 p.  
Forage production on treated (cabled, thinned, clearcut, strip cut, or sprayed with herbicide) and untreated ponderosa pine (*Pinus ponderosa*) and juniper (*Juniperus deppeana* and *J. osteosperma*) in Arizona is tabulated.
251. O'CONNELL, PAUL F., and HARRY E. BROWN. 1972. Use of production functions to evaluate multiple use treatments on forested watersheds. Water Resour. Res. 8:1188-1198.  
Illustrated (tables and graphs) are the changes in herbage production following clearcut and strip cut ponderosa pine (*Pinus ponderosa*), alligator juniper (*Juniperus deppeana*), and Utah juniper (*J. osteosperma*) on the Beaver Creek watershed in Arizona.
252. O'ROURKE, J. T., and P. R. OGDEN. 1969. Vegetative response following pinyon-juniper control in Arizona. J. Range Manage. 22:416-418.  
A table describing perennial grass production with and without (mechanically removed) pinyon (*Pinus edulis*) and juniper (*Juniperus monosperma* and *J. osteosperma*) is presented.
253. O'ROURKE, J. T., and P. R. OGDEN. 1970. Pinyon-juniper control: where? why? Prog. Agric. Ariz. 22(1):12-15.  
Total perennial grass and blue grama (*Bouteloua gracilis*) production on mechanically controlled and uncontrolled pinyon-juniper sites in east-central Arizona is graphically illustrated. Overstory is dominated by one-seed (*Juniperus monosperma*) and Utah juniper (*J. osteosperma*) and pinyon (*Pinus edulis*).
254. PARKER, KENNETH W., and S. CLARK MARTIN. 1952. The mesquite problem on southern Arizona ranges. U.S. Dep. Agric. Circ. 908, 70 p. Washington, D.C.  
Graphs and tables describe the relations of grass yields to overstory of velvet mesquite (*Prosopis juliflora*) and burroweed (*Aplopappus tenuisectus*).
255. PASE, C. P., P. A. INGEBRO, E. A. DAVIS, and C. Y. McCULLOCH. 1967. Improving water yield and game habitat by chemical control of chaparral. Int. Union For. Res. Organ. 14th Congr., Munich, Proc. 1:463-486.  
Three-dimensional graphs depict herbage production following wildfire and herbicidal treatment (2,4,5-T) to *Cercocarpus betuloides* and *Quercus emoryi* on the Three Bar Watersheds, Ariz.
256. PASE, CHARLES P. 1970. Chaparral modification improves range forage and water yield in Arizona. p. 16. In 23d Annu. Meet., Am. Soc. Range Manage., Denver, Colo.  
Herbage production with and without chemical control (2,4,5-T, fenuron, picloram, others) of chaparral stands is described.
257. PASE, CHARLES P. 1971. Effect of a February burn on Lehman lovegrass. J. Range Manage. 24:454-456.  
Herbage production following root plowing and before and after burning shrub live oak (*Quercus turbinella*) is given (table) for a study area in central Arizona.
258. PASE, CHARLES P., and A. W. LINDENMUTH. 1971. Effects of prescribed fire on vegetation in oak-mountain mahogany chaparral. J. For. 69:800-805.  
Herbaceous and shrub cover before and after prescribed fire in chaparral is given (tables and graph) for a study site on the Sierra Ancha Experimental Forest in central Arizona. Shrub live oak (*Quercus turbinella*) and true mountain mahogany (*Cercocarpus montanus*) dominate the overstory vegetation.
259. PASE, CHARLES P., and FLOYD W. POND. 1964. Vegetation changes following the Mingus Mountain burn. U.S. Dep. Agric. For. Serv., Res. Note RM-18, 8 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Comparative yields of grass, forbs, and shrubs following a wildfire are presented (tables) for an area in central Arizona. The overstory is dominated by shrub live oak (*Quercus turbinella*) and skunkbush sumac (*Rhus trilobata*).
260. PATTEN, DUNCAN T. 1978. Productivity and production efficiency of an upper Sonoran desert ephemeral community. Am. J. Bot. 65:891-895.  
In central Arizona, higher production efficiency for winter annuals existed under *Ceridium microphyllum* crowns than in the interspaces. Data are presented in graphic and tabular forms.
261. PATTON, DAVID R. 1969. Deer and elk use of a ponderosa pine forest in Arizona before and after timber harvest. U.S. Dep. Agric. For. Serv., Res. Note RM-139, 7 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.  
Herbage production and the number of browse plants before and after logging of ponderosa pine overstory are described.

262. PATTON, DAVID R. 1974. Patch cutting increases deer and elk use of a pine forest in Arizona. *J. For.* 72:764-766.
- Herbage production before and after clearcutting small patches of ponderosa pine (*Pinus ponderosa*), Gambel oak (*Quercus gambellii*), Douglas-fir (*Pseudotsuga menziesii*), true firs (*Abies spp.*), southwestern white pine (*P. strobiformis*), and quaking aspen (*Populus tremuloides*) are given in tabular form. Herbage yields are graphically related to ponderosa pine crown cover.
263. PATTON, DAVID R. 1976. Timber harvesting increases deer and elk use of a mixed conifer forest. U.S. Dep. Agric. For. Serv., Res. Note RM-329, 3 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Grass and forb production 3 years before and 2 years following a timber harvest of quaking aspen (*Populus tremuloides*) on the Apache National Forest in east-central Arizona is given (table).
264. PATTON, DAVID R., and B. IRA JUDD. 1970. The value of wet meadows as wildlife habitat in the Southwest. *J. Range Manage.* 23:272-275.
- Herbage production associated with wet meadow, moist transition, and dry forest sites is presented (table) for a study area in east-central Arizona. The density and frequency of grasses and forbs are given (table) for the different vegetation sites.
265. PEARSON, H. A., J. R. DAVIS, and G. H. SCHUBERT. 1972. Effects of wildfire on timber and forage production in Arizona. *J. Range Manage.* 25:250-253.
- Herbage quality and quantity are compared (tables) for burned and unburned ponderosa pine (*Pinus ponderosa*) overstory situations on the Wild Bill Range.
266. PEARSON, HENRY A. 1964. Studies of forage digestibility under ponderosa pine stands. *Proc. Soc. Am. For.* 1964:71-73.
- A logarithmic equation describing herbage production as a function of ponderosa pine overstory density is given for experimental range units in north-central Arizona.
267. PEARSON, HENRY A. 1967. Phenology of Arizona fescue and mountain muhly in the northern Arizona ponderosa pine type. U.S. Dep. Agric. For. Serv., Res. Note RM-89, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Growth rate of Arizona fescue (*Festuca arizonica*) leaves as related to percent ponderosa pine canopy cover is presented in tabular form.
268. PEARSON, HENRY A., and DONALD A. JAMESON. 1967. Relationship between timber and cattle production on ponderosa pine range: the Wild Bill Range. 10 p. U.S. Dep. Agric. For. Serv., Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- A relationship between herbage production and ponderosa pine overstory density is graphically illustrated for a study area in north-central Arizona.
269. PIEPER, REX D. 1968. Comparison of vegetation on grazed and ungrazed pinyon-juniper grassland sites in south-central New Mexico. *J. Range Manage.* 21:51-53.
- Tables showing total herbage production and percent composition by species for both protected and grazed areas at Fort Stanton are given.
270. PIEPER, REX D. 1971. Blue grama vegetation responds inconsistently to cholla cactus control. *J. Range Manage.* 24:52-54.
- A table describes herbage production on grubbed and ungrubbed cholla (*Opuntia imbricata*) sample plots in the Sacramento Mountains of New Mexico.
271. PIEPER, REX D. 1977. The southwestern pinyon-juniper ecosystem. In *Ecology, uses, and management of pinyon-juniper woodlands: proceedings of the workshop*. U.S. Dep. Agric. For. Serv., Gen. Tech. Rep. RM-39, 48 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Relationship of herbage to *Pinus-Juniperus* canopy cover is presented graphically.
272. POND, FLOYD W. 1961. Basal area and production of weeping lovegrass under varying amounts of shrub live oak crown cover. *J. Range Manage.* 14:335-337.
- The basal area and production of weeping lovegrass (*Eragrostis curvula*) and the reduction of shrub live oak (*Quercus turbinella*) after burning are graphically illustrated. Also, a linear predicting equation relating grass production to reduction of overstory canopy is given.
273. POND, FLOYD W. 1961. Mechanical control of Arizona chaparral and some results from brush clearing. *Annu. Ariz. Watershed Symp. Proc.* 5:39-41.
- Graphs describe relationship between basal area and production of weeping lovegrass (*Eragrostis curvula*) and reduction of shrub live oak (*Quercus turbinella*) canopy.
274. POND, FLOYD W. 1962. Shrub live oak limits production of weeping lovegrass. *Ariz. Cattlelog* 18(12):60-61.
- Relationship between production of weeping lovegrass and reduction of shrub live oak canopy after burning is graphically illustrated for a study area in central Arizona.
275. POND, FLOYD W. 1964. Response of grasses, forbs, and halfshrubs to chemical control of chaparral in central Arizona. *J. Range Manage.* 17:200-203.
- Herbage yields before and after spraying (2,4-D, 2,4,5-T) shrub live oak (*Quercus turbinella*) overstory are presented (graphs) for the Sierra Ancha Experimental Forest.
276. POND, FLOYD W. 1968. Changes in grass production on ungrazed converted chaparral. U.S. Dep. Agric. For. Serv., Res. Note RM-98, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Production and basal area of weeping lovegrass (*Eragrostis curvula*) related to control (2,4-D, 2,4,5-T) of shrub live oak (*Quercus turbinella*) overstory are described in graphic form for a study area in eastern Arizona.
277. POND, FLOYD W. 1969. Grazing values on undisturbed chaparral versus areas converted to grass: the Tonto Springs range. 14 p. U.S. Dep. Agric. For. Serv., Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Production of perennial grasses before and after root plowing of chaparral overstory is discussed for a study area in central Arizona.
278. POND, FLOYD W., and DWIGHT R. CABLE. 1962. Recovery of vegetation following wildfire on a chaparral area in Arizona. U.S. Dep. Agric. For. Serv., Res. Note RM-72, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Basal area of weeping lovegrass (*Eragrostis curvula*) as related to crown cover of shrub overstory inside and outside an enclosure is presented in a table. The overstory is mainly shrub live oak (*Quercus turbinella*).

279. REYNOLDS, H. G., and J. W. BOHNING. 1956. Effects of burning on a desert grass-shrub range in southern Arizona. *Ecology* 37:769-777.
- Density and production of perennial grasses are described (tables and graphs) before and after burning overstory on the Santa Rita Experimental Range. The overstory included burroweed (*Aplopappus tenuisectus*), cholla (*Opuntia* spp.), and mesquite (*Prosopis* spp.).
280. REYNOLDS, H. G., and F. H. TSCHIRLEY. 1957. Mesquite control on southwestern rangeland. U.S. Dep. Agric., Leaflet 421, 8 p. Washington, D.C.
- A relationship between forage production and mesquite abundance is graphically illustrated.
281. REYNOLDS, HUDSON G. 1959. Brush control in the Southwest. In *Grasslands*, p. 379-389. Am. Assoc. Advancement Sci., Publ. 53.
- The relative proportions of perennial grass and mesquite (*Prosopis juliflora*) overstory are graphically illustrated for southern Arizona and New Mexico.
282. REYNOLDS, HUDSON G. 1962. Effect of logging on understory vegetation and deer use in a ponderosa pine forest of Arizona. U.S. Dep. Agric. For. Serv., Res. Note 80, 7 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Understory vegetation production on logged and unlogged areas of ponderosa pine is presented (table). A graph illustrates the relationship between herbage yields and coniferous forest (ponderosa pine and Douglas-fir) overstory.
283. REYNOLDS, HUDSON G. 1962. Some characteristics and uses of Arizona's major plant communities. *J. Ariz. Acad. Sci.* 2:62-71.
- A literature review, including a description of relationships between herbage production and tree overstory, is presented for different vegetation types in Arizona.
284. REYNOLDS, HUDSON G. 1964. Elk and deer habitat use of a pinyon-juniper woodland in New Mexico. *Trans. North. Am. Wildl. Nat. Resour. Conf.* 29:438-444.
- Relations among perennial grasses, forbs, shrubs, and overstory density are presented in tabular form. The main overstory trees include pinyon (*Pinus edulis*), alligator (*Juniperus deppeana*) and Utah (*J. osteosperma*) juniper, and wavyleaf oak (*Quercus undulata*).
285. REYNOLDS, HUDSON G. 1966. Slash cleanup in a ponderosa pine forest affects use by deer and cattle. U.S. Dep. Agric. For. Serv., Res. Note RM-64, 3 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- Production of herbaceous vegetation on sample plots with slash cleared and slash undisturbed after logging ponderosa pine (*Pinus ponderosa*) overstory is presented (table) for a study area in northern Arizona.
286. REYNOLDS, HUDSON G. 1969. Aspen grove use by deer, elk, and cattle in a southwestern coniferous forest. U.S. Dep. Agric. For. Serv., Res. Note RM-138, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- A table describing understory production, including aspen (*Populus tremuloides*) sprouts, under aspen and under mixed conifer forest types is presented for north-central Arizona. Mixed conifer species include Douglas-fir (*Pseudotsuga menziesii*), subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), and ponderosa pine (*Pinus ponderosa*). A graph illustrating understory production in thinned and unthinned aspen groves is also included.
287. REYNOLDS, HUDSON G. 1969. Improvement of deer habitat on southwestern forest lands. *J. For.* 67:803-805.
- Relations of herbaceous understory to ponderosa pine (*Pinus ponderosa*) overstory densities of mature and immature tree age groups are presented (table) for a study area on the Kaibab Plateau in northern Arizona.
288. REYNOLDS, HUDSON G., WARREN P. CLARY, and PETER F. FFOLLIOTT. 1970. Gambel oak for southwestern wildlife. *J. For.* 68:545-547.
- Understory herbage production in relation to *Quercus gambelii* overstory is described for northern Arizona.
289. REYNOLDS, HUDSON G., and S. CLARK MARTIN. 1968. Managing grass-shrub cattle range in the Southwest. U.S. Dep. Agric., Agric. Handb. 162 rev., 44 p. Washington, D.C.
- The relation of proportion of full production of perennial grass and density of velvet mesquite (*Prosopis juliflora*) is described (graph) for the Santa Rita Experimental Range in southern Arizona. Also, a graph illustrating average herbage production on sprayed (2,4,5-T) and unsprayed mesquite-infested range at different points in time is presented.
290. SCHMUTZ, ERVIN M., and DAVID W. WHITHAM. 1962. Shrub control studies in the oak-chaparral of Arizona. *J. Range Manage.* 15:61-67.
- Increase in grass yields as related to percent reduction by chemicals (2,4,5-T and Silvex) in ground cover of shrub live oak (*Quercus turbinella*) overstory is illustrated (graphs) for a study area in central Arizona.
291. SCHUBERT, GILBERT H. 1974. Silviculture of southwestern ponderosa pine: the status of our knowledge. U.S. Dep. Agric. For. Serv., Res. Pap. RM-123, 71 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.
- The relationships between herbage production and tree density, basal area, and canopy closure of ponderosa pine (*Pinus ponderosa*) in the Southwest are illustrated (graphs).

292. SHORT, HENRY L., WAIN EVANS, and ERWIN L. BOEKER. 1977. The use of natural and modified pinyon pine-juniper woodlands by deer and elk. J. Wildl. Manage. 41:543-559.

Modification of *Pinus edulis*-*Juniperus* spp. woodlands at Fort Bayard, N. Mex., was investigated. Relationships obtained display total herbage, grasses, and forbs as a function of the density of tree overstory. Additional relationships include shrubs versus trees, and herbage versus shrubs.

293. SPRINGFIELD, H. W. 1976. Characteristics and management of southwestern pinyon-juniper ranges: the status of our knowledge. U.S. Dep. Agric. For. Serv., Res. Pap. RM-160, 32 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

Graphically illustrated are: the relationship between understory species and canopy intercept of pinyon-juniper (*Pinus* spp. and *Juniperus* spp.); and changes in plant cover and herbage yields 13 years after chemical (2,4-D; 2,4,5-T; and PBA) and mechanical (burning, chaining, pushing, and hand grubbing) control of pinyon-juniper woodlands on National Forest lands in Arizona and New Mexico.

294. THATCHER, ALBERT P., and VIRGIL L. HART. Spy Mesa yields better understanding of pinyon-juniper in range ecosystem. J. Range Manage. 27:354-357.

The interrelationships of soil, grasses, and overstories (*Pinus edulis* and *Juniperus osteosperma*) in Arizona are discussed.

295. TIEDEMANN, ARTHUR R., and JAMES O. KLEMMEDSON. 1971. Effect of mesquite (*Prosopis juliflora*) trees on vegetation and soils in the desert grassland. p. 15-16. In 24th Annu. Meet., Am. Soc. Range Manage., Reno.

Abundance of perennial grasses under canopies of mesquite overstory is described for a study area in southern Arizona.

296. TIEDEMANN, ARTHUR R., and JAMES O. KLEMMEDSON. 1977. Effect of mesquite trees on vegetation and soils in the desert grassland. J. Range Manage. 30:361-367.

At the Santa Rita Experimental Range in southern Arizona, *Prosopis juliflora* was studied in relation to an understory of herbage and shrubs. Effects on understory biomass and cover are reported.

297. TIEDEMANN, ARTHUR R., and ERVIN M. SCHMUTZ. 1966. Shrub control and reseeded effects on the oak chaparral of Arizona. J. Range Manage. 19:191-195.

Graphs illustrate the relationship between grass production and oak chaparral (*Quercus turbinella*) crown cover as modified by burning and an herbicide (Silvex).

298. URNESS, PHILIP J. 1974. Deer use changes after root plowing in Arizona chaparral. U.S. Dep. Agric. For. Serv., Res. Note RM-255, 8 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

On the Tonto Springs Range, Ariz., shrub live oak (*Quercus turbinella*) and other chaparral species were root plowed and sprayed with fenuron. Forb and grass production on treated and untreated plots are shown graphically.

299. WELSH, RICHARD G., and RELDON F. BECK. 1976. Some ecological relationships between creosotebush and bush muhly. J. Range Manage. 29:472-475.

Variation in several characteristics of creosotebush (*Larrea tridentata*) is given (tables) with and without bush muhly growing within the creosotebush canopy. Study was conducted near Las Cruces, N. Mex.

300. WHITTAKER, R. H., and W. A. NIERING. 1975. Vegetation of the Santa Catalina mountains, Arizona. V. Biomass, production, and diversity along the elevation gradient. Ecology 56:771-790.

Biomass and net primary productivity are given for the herbaceous, shrub, and tree layers for a variety of samples from fir (*Abies* spp.) forests to creosotebush (*Larrea divaricata*) deserts. The study was conducted in southern Arizona.

301. WRIGHT, HENRY A. 1978. The effect of fire on vegetation in ponderosa pine forests: a state-of-the-art review. Texas Tech University, Lubbock, Range and Wildl. Inf. Ser. 2, Coll. Agric. Sci. Publ. T-9-199, 21 p.

Presents data summaries from major *Pinus ponderosa* regions.

## Eastern

302. AHLGREN, CLIFFORD E. 1960. Some effects of fire on reproduction and growth of vegetation in northeastern Minnesota. Ecology 41:431-445.

Plant frequencies of understory vegetation are presented (tables) for burned and unburned study sites in the coniferous forests of the Lake States.

303. AHLGREN, H. L., M. L. WALL, K. J. MUCKENDRIM, and J. M. SURD. 1946. Yields of forage from woodland pastures on sloping land in southern Wisconsin. J. For. 44:709-711.

Forage yields are presented (tables) for woodland, natural openings, and renovated openings.

304. ALBAN, DAVID E. 1977. Influence on soil properties of prescribed burning under mature red pine. U.S. Dep. Agric. For. Serv., Res. Pap. NC-139, 8 p. North Cent. For. Exp. Stn., St. Paul, Minn.

In Minnesota, stands of *Pinus resinosa* were burned in the spring and summer annually, biennially, and periodically to control beaked hazel (*Corylus cornuta*). Average number of stems per acre of beaked hazel on treated and untreated plots is shown in tabulated form.

305. ANDERSON, R. C., O. L. LOUCKS, and A. M. SWAIN. 1969. Herbaceous response to canopy cover, light intensity, and throughfall precipitation in coniferous forests. Ecology 50:255-263.

A linear equation defines relationship between herbaceous understory cover and percent of overstory canopy cover for two stands of red pine and white pine in northern Wisconsin. Also, the relationship is graphically illustrated.

306. BASKETT, THOMAS S., ROBERT L. DUNKESON, and S. CLARK MARTIN. 1957. Responses of forage to timber stand improvement in the Missouri Ozarks. J. Wildl. Manage. 21:121-126.

The production of browse, grass, and forbs following release through girdling a post oak-blackjack oak forest in Missouri is presented with tables and graphs. The dominant overstory consisted of post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), black oak (*Q. velutina*), and hickory (*Carya texana*).

307. BASKETT, THOMAS S., ROBERT DUNKESON, and S. CLARK MARTIN. 1958. Ten-year timber cutting cycle provides a continuing supply of forage. U.S. Dep. Agric. For. Serv., Cent. States For. Exp. Stn., Stn. Note 125, 2 p. Columbus, Ohio.

The changes in frequencies of forbs, grasses, and browse following release (cutting) in a white oak stand are compared with understory vegetation in uncut white oak for a study area in the Missouri Ozarks.

308. BJUGSTAD, ARDELL J., DEAN A. MURPHY, and HEWLETTE S. CRAWFORD. 1968. Poor returns from Ozark woodland grazing. U.S. Dep. Agric. For. Serv., Res. Note NC-60, 2 p. North Cent. For. Exp. Stn., St. Paul, Minn.

Production of forage, including grasses and forbs, is given (table) for commercial forest types in the Missouri Ozarks. Forest types include black-scarlet oak, pine, pine-oak, mixed hardwood, and white oak.

309. BROWN, JAMES H., and CALVIN B. DUNWOODY. 1961. Aerial spraying of 2,4,5-T for releasing conifers in Rhode Island. J. For. 59:882-884.

Tables describe the effect of different applications of 2,4,5-T on hardwood understory. The spraying objective was to release high-valued white pine (*Pinus strobus*).

310. BROWN, JAMES H., JR. 1960. The role of fire in altering the species composition of forests in Rhode Island. Ecology 41:310-316.

The relative density of understory vegetation is described (tables) for burned and unburned upland sites in the woodlands of Rhode Island. Scarlet (*Quercus coccinea*), white (*Q. alba*), and black oak (*Q. velutina*) are the major overstory occupants.

311. BROWN, JAMES M. 1973. Effect of overstory removal on production of shrubs and sedge in a northern Minnesota bog. J. Minn. Acad. Sci. 38:96-97.

Frequency and cover of understory is presented in graphic and tabular form for forested and clearcut *Picea mariana* stands.

312. BUCKMAN, ROBERT E. 1964. Effects of prescribed burning on hazel in Minnesota. Ecology 45:626-629.

The density of hazel (*Corylus* spp.) associated with burning red pine (*Pinus resinosa*) overstory is presented in tabular form.

313. BUELL, MURRAY F., and JOHN E. CANTLON. 1953. Effects of prescribed burning on ground cover in the New Jersey pine region. Ecology 34:520-528.

The density of herbaceous vegetation with and without burning of pine-oak forest overstories is graphically illustrated.

314. COOK, DAVID B. 1939. Thinning for browse. J. Wildl. Manage. 3:201-202.

The effect of thinning second-growth northern hardwoods upon browse production is described for a study tract in New York.

315. CRAWFORD, H. S., and A. J. BJUGSTAD. 1967. Establishing grass range in the southwest Missouri Ozarks. U.S. Dep. Agric. For. Serv., Res. Note NC-22, 4 p. North Cent. For. Exp. Stn., St. Paul, Minn.

A comparison between grass production on study sites seeded and unseeded after spraying (2,4,5-T), burning, and fertilizing in hardwood stands is graphically illustrated. Overstory trees are primarily post and blackjack oak.

316. CRAWFORD, HEWLETTE S. 1976. Relationships between forest cutting and understory vegetation; an overview of eastern hardwood stands. U.S. Dep. Agric. For. Serv., Res. Pap. NE-349, 9 p. Northeast. For. Exp. Stn., Upper Darby, Pa.

Herbage production following varying intensities of cutting Ozark oak-hickory and Appalachian oak-pine stands is shown (tables).

317. CRAWFORD, HEWLETTE S., JR. 1971. Wildlife habitat changes after intermediate cutting for even-aged management. J. Wildl. Manage. 35:275-286.

Multiple regression analyses describe the relationships between growth of understory vegetation and forest overstory density and site quality for a study area in south-central Missouri. Also, growth of understory vegetation is described (tables) for different forest overstory levels and site quality classes. The overstory is dominated by black (*Quercus velutina*), white (*Q. alba*), scarlet (*Q. coccinea*), and northern red (*Q. rubra*) oak.

318. CRAWFORD, HEWLETTE S., JR., and WAYNE M. HARRISON. 1971. Wildlife food on three Ozark hardwood sites after regeneration cutting. J. Wildl. Manage. 35:533-537.

Understory vegetation production is described (table) by site class and growing seasons after regeneration (clear) cutting black (*Quercus velutina*) and scarlet oak (*Q. coccinea*) on the Ozark Plateau of south-central Missouri.

319. CROW, T. R. 1978. Biomass and production in three contiguous forests in northern Wisconsin. Ecology 59:265-273.

Biomass tabular data are given for tree, shrub, and ground vegetation from three forest communities containing *Populus*, *Betula*, and *Acer* overstories.

320. DALKE, PAUL D. 1941. The use and availability of the more common winter browse plants in the Missouri Ozarks. Trans. North. Am. Wildl. Conf. 6:155-160.

The yield of browse species in post oak-blackjack oak, black oak-hickory, and ravine forest cover types is given in tabulated form.

321. DEITSCHMAN, GLENN H. 1956. Growth of underplanted hardwoods in black locust and shortleaf pine plantations. U.S. Dep. Agric. For. Serv., Central States For. Exp. Stn., Stn. Note 94, 2 p. Columbus, Ohio.

Growth (height) of planted hardwood understory is presented (table) for black locust and shortleaf pine overstories for plantations in southern Illinois.

322. DILLER, OLIVER, D. 1937. The forage cover in heavily grazed farm woods of northern Indiana. J. Am. Soc. Agron. 29:924-933.

Frequency and percent cover of understory vegetation under oak-hickory and beech-maple overstories are graphically illustrated.

323. EHRENREICH, JOHN H. 1959. Releasing understory pine increased herbage production. U.S. Dep. Agric. For. Serv., Cent. States For. Exp. Stn., Stn. Note 139, 2 p. Columbus, Ohio.

Changes in forage production on sprayed (2,4,5-T) and unsprayed study areas in Missouri are graphically illustrated. The spraying objective was to release underplanted pine in mixed pine-oak woodlands.

324. EHRENREICH, JOHN H. 1960. Useable forage under pine stands. U.S. Dep. Agric. For. Serv., Cent. States For. Exp. Stn., Stn. Note 142, 2 p. Columbus, Ohio. Herbage production in relation to thinning intensity and time since thinning is described (graph) for a natural shortleaf pine stand on the Sinkin Experimental Forest in southern Missouri.
325. EHRENREICH, JOHN H., and ROBERT F. BUTTERY. 1960. Increasing forage on Ozark wooded range. U.S. Dep. Agric. For. Serv., Cent. States For. Exp. Stn., Stn. Tech. Pap. 177, 10 p. Columbus, Ohio.
- Forage production associated with the elimination of woody overstory, artificial seeding, and fertilization is described (graph) for study sites in the Missouri Ozarks. Overstory includes *Quercus velutina* (black oak), *Q. marilandica* (blackjack oak), *Q. coccinea* (scarlet oak), and *Q. stellata* (post oak).
326. EHRENREICH, JOHN H., ROBERT F. BUTTERY, and CHARLES W. GEHRKE. 1960. How good is Ozark forage? Univ. Missouri, Columbia, Agric. Exp. Stn. Bull. 759, 7 p.
- Forage produced on forest range is discussed.
327. EHRENREICH, JOHN H., and JOHN S. CROSBY. 1960. Forage production on sprayed and burned areas in the Missouri Ozarks. J. Range Manage. 13:68-70.
- Tables of herbage yields on sprayed (2,4,5-T), burned, and untreated (control) areas of blackjack (*Quercus marilandica*) and post oak (*Q. stellata*).
328. EHRENREICH, JOHN H., and JOHN S. CROSBY. 1960. Herbage production is related to hardwood crown cover. J. For. 58:564-565.
- Relationship between herbage production and hardwood overstory crown cover is graphically illustrated for the Missouri Ozarks. Overstory is dominated by blackjack (*Quercus marilandica*) and post oak (*Q. stellata*).
329. EHRENREICH, JOHN H., and DEAN A. MURPHY. 1962. A method of evaluating habitat for forest wildlife. Trans. North. Am. Wildl. Nat. Resour. Conf. 27:376-384.
- Grass, forb, and browse production in different stand size and stocking classes, and in several forest types, is given (tables) for the Missouri Ozarks.
330. EHRENREICH, JOHN H., and ROBERT A. RALSTON. 1963. Forage and timber production alternatives on shallow soils in the Ozarks. Proc. Soc. Am. For. 1963:80-83.
- Forage production associated with clearing of hardwood (oak-hickory) overstory is discussed.
331. ERDMANN, GAYNE G. 1967. Chemical weed control increases survival and growth in hardwood plantings. U.S. Dep. Agric. For. Serv., Res. Note NC-34, 4 p. North Cent. For. Exp. Stn., St. Paul, Minn.
- A relationship between chemical removal (atrazine, simazine) of herbaceous ground cover and resulting survival and growth of hardwood tree species is described (table) for a study area in east-central Iowa. Tree species include black walnut (*Juglans nigra*), red oak (*Quercus rubra*), yellow poplar (*Liriodendron tulipifera*), and white ash (*Fraxinus americana*).
332. GRIGAL, D. F., and LEWIS F. OHMANN. 1975. Classification, description, and dynamics of upland plant communities within a Minnesota wilderness area. Ecol. Monogr. 45:389-407.
- A table summarizing the percent cover of low shrubs, herbaceous plants, and ground cover plants for 13 upland plant community types within the Boundary Waters Canoe Area is given.
333. GYSEL, LESLIE W. 1957. Effects of silvicultural practices on wildlife food and cover in oak and aspen types of northern Michigan. J. For. 55:803-809.
- The frequency and production of understory plants associated with different cultural practices designed to eliminate oak overstory to release pine and associated with different harvest cutting practices for aspen are described. Cultural treatments analyzed included girdling; basal spraying with a mixture of 2,4-D and 2,4,5-T; 2,4,5-T applied in frills; and aerial spraying with 2,4,5-T. Aspen cutting experiments were complete clearcut and commercial clearcut.
334. GYSEL, LESLIE W., and FOREST STEARNS. 1968. Deer browse production of oak stands in central lower Michigan. U.S. Dep. Agric. For. Serv., Res. Note NC-48, 4 p. North Cent. For. Exp. Stn., St. Paul, Minn.
- Browse production is described (tables) in old growth (closed) and recently cut (open) oak stands. Overstory includes white (*Quercus alba*), northern red (*Q. rubra*), and northern pin oak (*Q. ellipsoidalis*), and red maple (*Acer rubrum*).
335. JORDAN, MARILYN J. 1975. Effects of zinc smelter emissions and fire on a chestnut oak woodland. Ecology 56:78-91.
- Percent cover of shrubs and herbs on burned and unburned study sites (dominated by *Quercus prinus*) near Lehigh Water Gap in Pennsylvania is shown in tabulated form.
336. KENNEDY, PATRICK C., and LOUIS F. WILSON. 1971. Understory vegetation associated with Saratoga spittlebug damage in Michigan red pine plantations. Can. Entomol. 103:1421-1426.
- Ground cover of understory is illustrated graphically and in tables in relation to spittlebug damage of *Pinus resinosa* overstory.
337. KNIERIM, PHILLIP G., KENNETH L. CARVELL, and JOHN D. GILL. 1971. Browse in thinned oak and cove hardwood stands. J. Wildl. Manage. 35:163-168.
- Density of seedling-origin and sprout-origin browse associated with different thinning patterns and intensities is given (tables) for study plots on the West Virginia University Forest. The dominant species in the oak plots were *Quercus coccinea* (scarlet oak), *Q. rubra* (northern red oak), and *Q. alba* (white oak); the dominant species in the cove hardwood plots were yellow poplar (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), and northern red oak.
338. KREFTING, L. W., and R. L. PHILLIPS. 1970. Improving deer habitat in upper Michigan by cutting mixed-conifer swamp. J. For. 68:701-704.
- Available browse production associated with different cutting practices is given in tabular form. The major overstory trees are *Thuja occidentalis* (white cedar), *Picea mariana* (black) and *P. glauca* (white spruce), and *Abies balsamea* (balsam fir).
339. KREFTING, LAURITS W., and CLIFFORD E. AHLGREN. 1974. Small mammals and vegetation changes after fire in a mixed conifer-hardwood forest. Ecology 55:1391-1398.
- Two burned areas and an unburned control site dominated by black spruce (*Picea mariana*), jack pine (*Pinus banksiana*), and paper birch (*Betula papyrifera*) on the Superior National Forest, Minn., were compared in terms of plant and animal species present. Changes in plant species composition (percent) following wildfire are shown (graphs and tables).



340. KREFTING, LAURITS W., and HENRY L. HANSEN. 1969. Increasing browse for deer by aerial applications of 2,4-D. J. Wildl. Manage. 33:784-790.  
In the Tamarac National Wildlife Refuge in Minnesota, herbicide was applied to plots in each of four cover types: aspen (*Populus tremuloides*), jack pine (*Pinus banksiana*), oak (*Quercus* spp.), and upland brush. Browse production for treated and control plots is given in tabulated form.
341. LOOMIS, ROBERT M. 1977. Wildfire effects on an oak-hickory forest in southeast Missouri. U.S. Dep. Agric. For. Serv., Res. Note NC-219, 4 p. North Cent. For. Exp. Stn., St. Paul, Minn.  
Herbaceous and woody understory was studied in burned and unburned *Quercus-Carya* forest stands. Data are given in tabulated and graphic forms.
342. LUTZ, H. J. 1932. Relation of forest site quality to number of plant individuals per unit area. J. For. 30:34-38.  
Compares the number of herbaceous and shrubby individuals and the number of trees on good and poor sites for a study area in Connecticut.
343. MARQUIS, DAVID A. 1974. The impact of deer browsing on Allegheny hardwood regeneration. U.S. Dep. Agric. For. Serv., Res. Pap. NE-308, 8 p. Northeast. For. Exp. Stn., Upper Darby, Pa.  
On the Allegheny Plateau (Pennsylvania and New York), deer exclosures were created on areas of hardwood stands (*Acer* spp., *Betula* spp., *Populus* spp., et al.) that had been clearcut 5 to 16 years earlier. Percent ground cover of rubus, ferns, and grasses on fenced and unfenced plots is shown in tabulated form.
344. MARTIN, S. CLARK, ROBERT L. DUNKESON, and THOMAS S. BASKETT. 1955. Timber harvests help offset forage decline in Missouri-managed forests. J. For. 53:513-516.  
The frequency and composition of forage plants in openings and under *Quercus alba* (white oak) and *Q. velutina* (black oak) forest canopy are compared graphically and in tables.
345. MAXEY, WILLIAM R. 1976. Response of greenbrier to various silvicultural treatments under oak stands. Wildl. Soc. Bull. 4:186-188.  
Number of greenbrier (*Smilax* spp.) stems per hectare are graphically compared to various silvicultural treatments applied to mixed oak (*Quercus* spp.) overstory on the West Virginia University Forest.
346. MURPHY, DEAN A., and HEWLETTE S. CRAWFORD. 1970. Wildlife foods and understory vegetation in Missouri's National Forests. Missouri Dep. Conserv., Tech. Bull. 4, 47 p.  
A relationship between average understory yields and average overstory density is described for different forest types. Also, production of preferred wildlife foods as related to overstory density, and understory production in relation to logging and timber stand improvement work is presented in tabular form. Black and scarlet oak (*Quercus velutina* and *Q. coccinea*) forest type is the most abundant, with lesser acreage of white oak (*Q. alba*), post and blackjack oak (*Q. stellata* and *Q. marilandica*), and other forest types.
347. MURPHY, DEAN A., and JOHN H. EHRENREICH. 1956. Fruit-producing trees and shrubs in Missouri's Ozark forests. J. Wildl. Manage. 29:497-503.  
The abundance of fruit-producing trees and shrubs as related to forest types and the abundance and fruiting of trees and shrubs as related to percent of overstory crown cover are presented in tabulated form.
348. MURPHY, DEAN A., and JOHN H. EHRENREICH. 1964. Effects of timber harvest and stand improvement on forage production. J. Wildl. Manage. 29:734-739.  
Forage production following timber harvest or timber stand improvement of different forest types in Missouri Ozarks is given in tabulated form. Forest types considered were pine (*Pinus echinata*), oak-pine, black oak-scarlet oak, white oak, and red cedar.
349. NIERING, WILLIAM A., and RICHARD H. GOODWIN. 1974. Creation of relatively stable shrublands with herbicides: arresting "succession" on right-of-way and pastureland. Ecology 55:784-795.  
Within the Connecticut Arboretum, *Quercus rubra*, *Q. alba*, and *Q. velutina* (red, white, and black oak) were sprayed with 2,4,5-T - fuel oil combination. Percent cover of vascular plants (trees, shrubs, vines, and herbs) before treatment and 2 decades following conversion is given (table).
350. OHMANN, LEWIS F., and DAVID F. GRIGAL. 1979. Early revegetation and nutrient dynamics following the 1971 Little Sioux forest fire in northeastern Minnesota. For. Sci. Monogr. 21, 80 p.  
Plant communities primarily dominated by *Pinus banksiana* and by *Populus-Betula* were studied following wildfire. Changes through time by cover and biomass for both overstory and understory are presented in tabulated and graphic form.
351. OVINGTON, J. D., DALE HEITKAMP, and DONALD B. LAWRENCE. 1963. Plant biomass and productivity of prairie, savanna, oakwood, and maize field ecosystems in central Minnesota. Ecology 44:52-63.  
Total production of understory and overstory is presented (tables) for the Cedar Creek Natural History Area. The overstory is dominated by bur (*Quercus microcarpa*) and northern red oak (*Q. rubra*).
352. PERALA, DONALD A. 1974. Repeated prescribed burning in aspen. U.S. Dep. Agric. For. Serv., Res. Note NC-171, 4 p. North Cent. For. Exp. Stn., St. Paul, Minn.  
Regeneration and recovery of volume growth of shrubs after repeated burning of quaking aspen (*Populus tremuloides*) on the Chippewa National Forest, Minn., are given (table and graphs).
353. PETERS, ELROY J., and WILLIS G. VOGEL. 1963. Increasing forage production on Ozark ranges by spraying, seeding, and fertilizing. Agron. Abstr. 1963:121.  
Herbage production following spraying (2,4,5-T), seeding (mixtures of perennial grasses), and fertilizing (8-24-8) on a forest range is discussed. Overstory species include *Quercus stellata* (post oak), *Q. marilandica* (blackjack oak), *Q. alba* (white oak), and *Q. velutina* (black oak).
354. PHILLIPS, JOHN J. 1963. Advance reproduction under mature oak stands of the New Jersey coastal plain. U.S. Dep. Agric. For. Serv., Res. Note NE-4, 5 p. Northeast For. Exp. Stn., Upper Darby, Pa.  
The average density of woody understory vegetation under oak stands is given by sites, including wet, moist, and dry (table).
355. PRUETT, EMERSON W., and GORDON E. GATHERUM. 1962. Control of herbaceous vegetation in forest plantings. Iowa Acad. Sci. 68:153-161.  
Relationships between control (chemical and mechanical) of herbaceous vegetation and survival and growth of planted tree species on a study area in east-central Iowa are discussed. Tree species include eastern white (*Pinus strobus*) and jack pine (*P. banksiana*), black walnut (*Juglans nigra*), and the eastern cottonwood (*Populus deltoides*).

356. REINERS, W. A. 1972. Structure and energetics of three Minnesota forests. *Ecol. Monogr.* 42:71-94.  
Three topographic gradients representing three forest types: oak (*Quercus ellipsoidalis*), fen (dominant species: *Fraxinus nigra*, *Acer rubrum*, and *Ulmus americana*), and cedar swamp (*Thuja occidentalis*) on the Anoka Sand Plain were compared in terms of radiation, biomass, production, and detritus weight and energy values. Total biomass and annual aerial production for herbaceous and low shrub species are also given for the three gradients (table).
357. ROGERS, NELSON F., and K. A. BRINKMAN. 1965. Shortleaf pine in Missouri: understory hardwoods retard growth. U.S. Dep. Agric. For. Serv., Res. Pap. CS-15, 9 p. Cent. States For. Exp. Stn., Columbus, Ohio.  
Relationship between control of hardwood understory and shortleaf pine (*Pinus echinata*) is presented in tabular form.
358. SHARP, WARM M. 1963. The effects of habitat manipulation and forest succession on ruffed grouse. *J. Wildl. Manage* 27:664-667.  
Increases in understory vegetation following the cutting of openings in *Quercus* spp. (oak) communities on Pennsylvania State game lands are described.
359. SICCAMA, THOMAS G. 1974. Vegetation, soil, and climate on the Green Mountains of Vermont. *Ecol. Monogr.* 44:325-349.  
Along an altitudinal gradient on the Green Mountains, there exist three forest types: deciduous (dominated by *Acer saccharum*, *Fagus grandifolia*, and *Betula alleghaniensis*), transitional (*Picea rubens* and *Abies balsamea*), and boreal (*Abies balsamea* and *Betula papyrifera*). Presence percentages of understory trees, shrubs, and herbs are shown (table and graph).
360. SMITH, RICHARD MERIWETHER. 1942. Some effects of black locusts and black walnuts on southeastern Ohio pastures. *Soil Sci.* 53:385-398.  
Tabular values show a slight increase in herbage production and protein content under widely spaced black locust and black walnut trees, as compared to no trees.
361. TAYLOR, R. J., and R. W. PEARCY. 1976. Seasonal patterns of the CO<sub>2</sub> exchange characteristics of understory plants. *Can. J. Bot.* 54:1094-1103.  
In a New York study, carbon dioxide exchange characteristics of understory plants were shown to vary according to the relation of their phenology to timing of overstory deciduous leaf development.
362. TIERSON, WILLIAM C., EARL F. PATRIC, and DONALD F. BEHREND. 1966. Influence of white-tailed deer on the logged northern hardwood forest. *J. For.* 64:801-805.  
Average height and density of woody shrubs at different time periods following partial cutting of *Acer saccharum* (sugar maple), *Fagus grandifolia* (beech), and *Betula alleghaniensis* (yellow birch) overstory are graphically illustrated for deer exclosures in the central Adirondacks of New York.
363. VOGEL, WILLIS G., and ELROY J. PETERS. 1961. Spraying, seeding, and fertilizing increase forage on Ozark ranges. U.S. Dep. Agric. For. Serv., Cent. States For. Exp. Stn., Stn. Note 152, 2 p. Columbus, Ohio.  
Herbage yields before and after spraying (2,4,5-T) post oak (*Quercus stellata*) overstory and yields associated with different seeding and fertilizing treatments are given.
364. WHITFORD, PHILIP C., and PHILIP B. WHITFORD. 1978. Effects of trees on ground cover in oil field succession. *Am. Midl. Nat.* 99:435-443.  
The cover of herbaceous understory in relation to *Quercus ellipsoidalis* overstory was studied in central Wisconsin. Data are presented in tabular form.
365. WHITTAKER, R. H., and G. M. WOODWELL. 1969. Structure, production, and diversity of the oak-pine forest at Brookhaven, New York. *J. Ecol.* 57:155-174.  
Tables describe the production of different plant life forms on a study site in New York. The overstory is dominated by *Quercus alba* (white oak) and *Q. coccinea* (scarlet oak).
366. ZAVITKOVSKI, J. 1976. Ground vegetation biomass, production, and efficiency of energy utilization in some northern Wisconsin forest ecosystems. *Ecology* 57:694-706.  
Understory characteristics under forest overstories, including *Populus tremuloides*, *Betula papyrifera*, *Acer rubrum*, *Quercus rubra*, *Tilia americana*, and *Fraxinus americana* are presented in tabular form.

## Southern

367. BEASOM, SAMUEL L., and CHARLES J. SCIFRES. 1977. Population reactions of selected game species to aerial herbicide applications in south Texas. *J. Range Manage.* 30:138-142.  
Honey mesquite (*Prosopis glandulosa*) was sprayed with 2,4,5-T and picloram. Herbage production, frequency, and density were described for sprayed and unsprayed areas.
368. BJERREGAARD, R. S., J. A. KEATON, K. E. McNEILL, and L. C. WARNER. 1968. Rangeland brush and weed control with tebuthiuron. *In Proc. First Int. Rangeland Cong.* p. 654-656. Denver, Colo.

372. BLAIR, ROBERT M. 1971. Forage production after hardwood control in a southern pine-hardwood stand. *For. Sci.* 17:279-284.  
Herbage and browse yields before and after four intensities and two methods (girdling and the herbicide Ammate) of hardwood removal are given (table) for a study area in central Louisiana. Predominant overstory species include *Pinus taeda* (loblolly pine) and *P. echinata* (shortleaf pine) with *Quercus stellata* (post oak) comprising 75 percent of the hardwood stocking.
373. BLAIR, ROBERT M., and LOUIS E. BRUNETT. 1976. Phytosociological changes after timber harvest in a southern pine ecosystem. *Ecology* 57:18-32.  
Following a selection timber harvest of *Pinus taeda*, *P. echinata*, *Quercus alba*, and *Q. falcata* on the Kisatchie National Forest, La., changes in the plant community were studied for 11 years. Net primary productivity in the herb and shrub strata is given (table and graph).
374. BLAIR, ROBERT M., and HANS G. ENGHARDT. 1976. Deer forage and overstory dynamics in a loblolly pine plantation. *J. Range Manage.* 29:104-108.  
Linear and logarithmically transformed variables were used to analyze the relationship between herbage yields and pine and hardwood overstories. Some graphic relations are presented. Study was conducted on Alexander State Forest in central Louisiana on loblolly pine (*Pinus taeda*) plantations. Sweetgum (*Liquidambar styraciflua*) was the principal midstory component.
375. BLAIR, ROBERT M., and DONALD P. FEDUCCIA. 1977. Midstory hardwoods inhibit deer forage in loblolly pine plantations. *J. Wildl. Manage.* 41:677-684.  
In central Louisiana, studies were made of a *Pinus taeda* overstory, a hardwood (mainly *Liquidambar styraciflua*) midstory, and a browse and herbaceous understory. Tables show relation between overstory and midstory, between midstory removal and understory responses, and between herbage and residual overstory.
376. BOVEY, R. W., R. E. MEYER, and H. L. MORTON. 1972. Herbage production following brush control with herbicides in Texas. *J. Range Manage.* 25:136-142.  
Live oak (*Quercus virginiana*) whitebrush (*Aloysia lycioides*), yaupon (*Ilex vomitoria*) and other species were controlled by chemicals (picloram, bromacil, 2,4,5-T, dicamba, atrazine, and 2,4-D). Effects on herbage production are discussed (tables).
377. BOWER, DAVID R., and EDWIN R. FERGUSON. 1968. Removal improves shortleaf pine growth. *J. Range Manage.* 21:420-422.  
On the mountains of Arkansas, complete and partial removal of overstory increased growth of shortleaf pine. Linear prediction equations are given for herbage production.
378. BOWER, DAVID R., and D. LYNN. 1970. Herbage production in a south Texas chaparral community. *J. Range Manage.* 23:30-32.  
On study plots in a south Texas chaparral community, herbage production was measured under different overstory communities.
379. BRATTON, SUSAN POWER. 1975. A comparison of the beta diversity functions of the overstory and herbaceous understory of a deciduous forest. *Bull. Torrey Bot. Club* 102:55-60.  
In the Great Smoky Mountains National Park, Tenn., diversities of understory and overstory changed at different rates with changes in environmental conditions. Data are presented graphically for these *Fagus grandifolia*-dominated overstories.
380. BRENDER, ERNST V., W. HENRY McNAB, and SHELTON WILLIAMS. 1976. Fuel accumulations in Piedmont loblolly pine plantations. U.S. Dep. Agric. For. Serv., Res. Note SE-233, 4 p. Southeast. For. Exp. Stn., Asheville, N.C.  
On the Hitchiti Experimental Forest, loblolly pines (*Pinus taeda*) were planted following clearcutting and slash burning. Green fuel (grasses, herbs, and vines) accumulation in loblolly pine plantations is given (graph).
381. BRITTON, CARLTON M., and HENRY A. WRIGHT. 1971. Correlation of weather and fuel variables to mesquite damage by fire. *J. Range Manage.* 24:136-141.  
Grass production with and without burning mesquite (*Prosopis glandulosa*) overstory is given for a study area in Texas.
382. BROCK, JOHN H., R. H. HAAS, and J. C. SHAVER. 1978. Zonation of herbaceous vegetation associated with honey mesquite in north-central Texas. *In Proc. First Int. Rangeland Cong.* p. 187-189. Denver, Colo.  
*Prosopis glandulosa* overstory was reduced by chemical and mechanical methods. Understory compositions are presented in graphic form and understory production data are given in tabulated form.
383. BYRD, NATHAN A., and CLIFFORD E. LEWIS. 1967. Managing southern pine forests to produce forage for beef cattle. USDA For. Serv., Southeast. Area, State and Private For., For. Manage. Bull. Atlanta, Ga.  
Relationship between pounds of forage and percent tree canopy is presented in graphic form for southern pine forests. Forage production under different forage stand ages is given in tabular form.
384. CAMPBELL, R. S. 1946. Determination of grazing values of native vegetation of southern pine forest ranges. *Ecology* 27:195-204.  
Herbage production under different overstory communities is given for a study area on the Kisatchie National Forest, La. The major overstory trees include longleaf (*Pinus palustris*) and slash pine (*P. caribaea*) and blackjack oak (*Quercus marilandica*).
385. CAMPBELL, ROBERT S. 1955. Vegetational changes and management in the cutover longleaf-slash pine area of the Gulf Coast. *Ecology* 36:29-34.  
A literature review, including examples of changes in herbaceous understory vegetation as related to timber cutting, burning, and grazing, is presented for the Coastal Plain.
386. CAMPBELL, ROBERT S., and JOHN T. CASSADY. 1949. Determining forage weight on southern forest ranges. *J. Range Manage.* 2:30-32.  
Grass production under longleaf pine forest overstory is described for Louisiana.

387. CAMPBELL, ROBERT S., and JOHN T. CASSADY. 1951. Grazing values for cattle on pine forest ranges in Louisiana. La. Agric. Exp. Stn., Baton Rouge, Bull. 452, 31 p.

Grass production associated with different forest grazing types is presented in tabular form. Grazing types considered include creek bottom hardwoods, loblolly pine-hardwoods, scrub oak, longleaf pine, open forest, and grassland.

388. CASSADY, JOHN T. 1951. Bluestem range in the piney woods of Louisiana and east Texas. J. Range Manage. 4:173-177.

Grass production under different forest overstory stand conditions and species composition is given. Overstory is dominated by longleaf pine and slash pine.

389. CASSADY, JOHN T. 1952. Grass production doubled by control of scrub oak. J. For. 50:462-463.

In Louisiana, grass production is presented (tables) after controlling (girdling and poisoning with Ammate) blackjack (*Quercus marilandica*) and post oak (*Q. stellata*) overstory.

390. CLARY, WARREN P. 1979. Grazing and overstory effects on rotationally burned slash pine plantation ranges. J. Range Manage. 32:264-266.

A relationship between herbage production and *Pinus elliotii* is given in equation form for central Louisiana.

391. COX, AMURICE, and HARRY M. ELWELL. 1944. Brush removal for pasture improvement. Agric. Eng. 25:253-261.

Grass densities under various amounts of blackjack and white oak canopy are given (table) for a study site in central Oklahoma.

392. CRAWFORD, HEWLETTE S. 1960. Effect of aerial 2,4,5-T sprays on forage production in west-central Arkansas. J. Range Manage. 13:44.

A table describing grass, forb, and browse production under sprayed (2,4,5-T) and unsprayed stands of post (*Quercus stellata*) and blackjack oak (*Q. marilandica*), and hickories (*Carya* spp.) is presented for a study area in the Ozark Mountains.

393. CRAWFORD, HEWLETTE S., JAMES B. WHELAN, RICHARD F. HARLOW, and JOHN E. SKEEN. 1975. Deer range potential in selective and clearcut oak-pine stands in southwestern Virginia. U.S. Dep. Agric. For. Serv., Res. Pap. SE-134, 12 p. Southeast. For. Exp. Stn., Asheville, N.C.

Amounts of understory production in selective and clearcut pitch pine (*Pinus rigida*) and oak (*Quercus* spp.) stands in the Jefferson National Forest are compared (tables).

394. CUSHWA, CHARLES T., ERNST V. BRENDER, and ROBERT W. COOPER. 1966. The response of herbaceous vegetation to prescribed burning. U.S. Dep. Agric. For. Serv., Res. Note SE-53, 2 p. Southeast. For. Exp. Stn., Asheville, N.C.

Herbaceous plant response to burning of loblolly pine (*Pinus taeda*) overstory is described (tables) for a study area on the Hitchiti Experimental Forest in Georgia.

395. CUSHWA, CHARLES T., MELVIN HOPKINS, and BURL S. MCGINNIS. 1970. Reponse of legumes to prescribed burns in loblolly pine stands of the South Carolina Piedmont. U.S. Dep. Agric. For. Serv., Res. Note SE-140, 6 p. Southeast. For. Exp. Stn., Asheville, N.C.

The frequency of occurrence of leguminous plants before and after burning on study sites dominated by loblolly pine (*Pinus taeda*) overstory is given in tabular form.

396. CUSHWA, CHARLES T., and M. B. JONES. 1969. Wildlife food plants on chopped areas in the Piedmont of South Carolina. U.S. Dep. Agric. For. Serv., Res. Note SE-119, 4 p. Southeast. For. Exp. Stn., Asheville, N.C.

The frequency of occurrence and abundance of leguminous plants and herbaceous plants other than legumes on study areas where loblolly pine overstory has been clearcut and chopped (drum chopper) or left uncut are presented in tabular form.

397. CUSHWA, CHARLES T., and JOHN B. REDD. 1966. One prescribed burn and its effect on habitat on the Powhatan game management area. U.S. Dep. Agric. For. Serv., Res. Note SE-61, 2 p. Southeast. For. Exp. Stn., Asheville, N.C.

A comparison among number, kind, and production of game food plants in cut, burned, and untreated pine stands in the Piedmont of Virginia is given in tabular form.

398. DAHL, B. E., R. E. SOSEBEE, J. P. GOEN, and C. S. BRUMLEY. 1978. Will mesquite control with 2,4,5-T enhance grass production? J. Range Manage. 31:129-131.

Effect of controlling *Prosopis glandulosa* was studied in western Texas. Response of herbaceous understory, primarily *Buchloe dactyloides* and *Hilaria mutica*, is given in tabular form.

399. DALRYMPLE, R. L., DON D. DWYER, and P. W. SANTLEMANN. 1964. Vegetational responses following winged elm and oak control in Oklahoma. J. Range Manage. 17:249-253.

Herbage yields under overstory that was killed (2,4,5-T) or left alive are presented in tabular form. Overstory is dominated by blackjack (*Quercus marilandica*) and post oak (*Q. stellata*) and winged elm (*Ulmus alata*).

400. DANIELL, JEFF W., and W. S. HARDCASTLE. 1972. Response of peach trees to herbicide and mechanical weed control. Weed Sci. 20:133-136.

Orchards of 1- and 2-year-old peach trees (*Prunus persica*) were treated with preemergence herbicides (simazine, dichlobenil, natrialin, CP-44939, and alachlor) and postemergence herbicides (paraquat, terbacil, diphenamid, dinoseb, and chloropropham plus dinoseb plus PPG-124) at Experiment and Fort Valley, Ga. Broadleaf and grass weed control was evaluated in tabular form.

401. DARROW, ROBERT A., and WAYNE G. MCGULLEY. 1959. Brush control and range improvement in the post oak-blackjack oak area of Texas. Tex. Agric. Exp. Stn., College Station, Bull. 942, 16 p.

Forage yields and composition on post oak-blackjack oak woodlands subjected to partial and compete removal (mechanical and chemical) of overstory are compared (tables) to undisturbed sites.

402. DODD, J. D., and S. T. HOLTZ. 1972. Integration of burning with mechanical manipulation of south Texas grassland. J. Range Manage. 25:130-136.

Herbage production following removal of mesquite (*Prosopis glandulosa*) and other brush species is presented (graphs).

403. DRAWE, D. LYNN. 1977. A study of five methods of mechanical brush control in south Texas. Rangeland's J. 4:37-39.

Herbage production with and without control of mixed brush overstory is graphically presented.

404. DUVALL, V. L., and L. K. HALLS. 1962. Outlook for beef cattle on southern forest ranges. *Proc. Soc. Am. For.* 1962:76-79.
- Herbaceous growth under different timber conditions and prescribed burning schedules is given (table) for longleaf and slash pine stands in the Eastern Gulf and Atlantic Coastal States.
405. DUVALL, V. L., and J. B. HILMON. 1965. New grazing research programs for southern forest ranges. *J. Range Manage.* 18:132-136.
- Average herbage yields under heavily stocked longleaf pine and slash pine stands, and where stands are scattered or absent, are given for the Coastal Plain, from east Texas to South Carolina.
406. DUVALL, VINSON L., and HAROLD E. GRELEN. 1967. Fertilization uneconomic for forage improvement in Louisiana pine plantations. U.S. Dep. Agric. For. Serv., Res. Note SO-51, 3 p. South. For. Exp. Stn., New Orleans, La.
- Herbage yield and quality associated with different fertilizer treatments (N, P, and K) applied on slash pine (*Pinus elliottii*) plantations are described in tabular form.
407. ELWELL, HARRY M. 1953. New herbicide controlled oak brush and resulted in increased native grass production. *Weeds* 2:302-303.
- The increase in production of native grasses following chemical control (2,4,5-T) of post oak and blackjack oak is described for a study area at the Red Plains Conservation Experiment Station, Okla.
408. ELWELL, HARRY M. 1960. Land improvement through brush control. *Soil Conserv.* 26:56-59.
- Production of native grasses with and without chemical control (2,4,5-T) of woody overstory is described for Oklahoma and nearby States. Overstory species include post, blackjack, and dwarf chinquapin oaks and scrub hickory.
409. ELWELL, HARRY M. 1964. Oak brush control improves grazing lands. *Agron. J.* 56:411-415.
- Native grass yields are presented (table) with and without control (2,4,5-T) of overstory dominated by post (*Quercus stellata*), blackjack (*Q. marilandica*), and dwarf chinquapin oak (*Q. prinoides*) for study areas throughout eastern Oklahoma.
410. FITZGERALD, C. H., R. F. RICHARDS, C. W. SELDEN, and J. T. MAY. 1975. Three-year effects of herbaceous weed control in a sycamore plantation. *Weed Sci.* 23:32-35.
- On the Piedmont Plateau in Georgia, American sycamore (*Platanus occidentalis*) were planted and treated with simazine, atrazine, dalapon, and ametryne herbicides. Percent weed control and sycamore survival during the first growing season are shown (tables).
411. GAINES, E. M., R. S. CAMPBELL, and J. J. BRASINGTON. 1954. Forage production on longleaf pine stands of southern Alabama. *Ecology* 35:59-62.
- A polynomial predicting equation describes herbage production as a function of forest overstory density. Also, a linear equation relating herbage production to forest overstory litter is given. The overstory is dominated by longleaf pine (*Pinus palustris*).
412. GEORGE, JAMES F., and JEFF POWELL. 1979. Cattle grazing impacts on small cleared areas in dense American elm woodlands. *J. Range Manage.* 32:78-79.
- Herbaceous data are given in graphic form for an *Ulmus americana* overstory in Oklahoma.
413. GILLS, GARY G. 1970. Effects of prescribed burning on deer browse. *J. Wildl. Manage.* 34:540-545.
- Available browse is graphically illustrated for burned and unburned study areas on the Cumberland Plateau in Tennessee. Shortleaf pine (*Pinus echinata*) was the predominant pine species, and white (*Quercus alba*) and chestnut oak (*Q. prinus*), the predominant hardwood species.
414. GOLDEN, MICHAEL S. 1979. Forest vegetation of the lower Alabama Piedmont. *Ecology* 60:770-782.
- Presence data for understory shrubs and herbs are given for a number of *Quercus-Pinus* stands.
415. GONZALEZ, C. L., and J. D. DODD. 1979. Production response of native and introduced grasses to mechanical brush manipulation, seeding and fertilization. *J. Range Manage.* 32:305-309.
- Tabular and graphic data show herbage yield with and without mechanical control of *Leucophyllum frutescens*, *Acacia rigidula*, *Karwinskia humboldtiana*, *Bumelia celastrina*, *Prosopis glandulosa*, and *Schaefferia cuneifolia*. Investigations were on the Rio Grande Plain of Texas.
416. GRANO, CHARLES X. 1970. Small hardwoods reduce growth of pine overstory. U.S. Dep. Agric. For. Serv., Res. Pap SO-55, 9 p. South. For. Exp. Stn., New Orleans, La.
- In Arkansas, the growth of loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*) before and after control (2,4,5-T) of a hardwood understory is graphically illustrated.
417. GREENE, S. W. 1935. Relation between winter grass fires and cattle in the longleaf pine belt. *J. For.* 33:338-341.
- Increases in forage production after burning longleaf pine on the McNeill Experimental Area in Mississippi are described.
418. GRELEN, H. E., and E. A. EPPS, JR. 1967. Herbage response to fire and litter removal on southern bluestem range. *J. Range Manage.* 20:403-404.
- Periodic herbage yields after burning and mowing sites clearcut of longleaf pine (*Pinus palustris*) overstory are given (table) for a study area in central Louisiana.
419. GRELEN, H. E., L. B. WHITAKER, and R. E. LOHREY. 1972. Herbage response to precommercial thinning in direct-seeded slash pine. *J. Range Manage.* 25:435-437.
- On the Palustris Experimental Forest in central Louisiana, slash pine (*Pinus elliottii*) were thinned to varying densities. The linear relationship between herbage production and pine basal area is given (graph and table).
420. GRELEN, HAROLD E. 1975. Vegetative response to twelve years of seasonal burning on a Louisiana longleaf pine site. U.S. Dep. Agric. For. Serv., Res. Note SO-192, 4 p. South. For. Exp. Stn., New Orleans, La.
- Herbage yield after 12 years of biennial burning of longleaf pines (*Pinus palustris*) is graphically illustrated. No significant differences in herbage yield were found among burning treatments and an unburned control.
421. GRELEN, HAROLD E. 1976. Responses of herbage, pines, and hardwoods to early and delayed burning in a young slash pine plantation. *J. Range Manage.* 29:301-303.
- The relation of herbage yield to slash pine (*Pinus elliottii*) plantation age is described (graph) in central Louisiana.

422. GRELEN, HAROLD E. 1978. Forest grazing in the South. *J. Range Manage.* 31:244-250.  
Herbaceous understory-forest overstory relationships are described for southern and southeastern United States. Forest overstories are predominantly *Pinus* spp. and *Quercus* spp.
423. GRELEN, HAROLD E. 1978. Winter and spring prescribed fires on Louisiana pine-bluestem range. *In Proc. First Int. Rangeland Cong.* p. 242-244. Denver, Colo.  
Herbage yields are given for *Pinus elliotii* plantations of different ages. Data are presented in graphic form.
424. GRELEN, HAROLD E., and HANS G. ENGHARDT. 1973. Burning and thinning maintain forage in a longleaf pine plantation. *J. For.* 71:419-425.  
Average herbage yields after prescribed burning and thinning of southern waxmyrtle (*Myrica cerifera*), blackjack oak (*Quercus marilandica*), blackgum (*Nyssa sylvatica*), and flowering dogwood (*Cornus florida*) in the Palustris Experimental Forest in Louisiana are graphically illustrated.
425. GRELEN, HAROLD E., and RICHARD E. LOHREY. 1978. Herbage yield related to basal area and rainfall in a thinned longleaf plantation. U.S. Dep. Agric. For. Serv., Res. Note SO-232. 4 p. South. For. Exp. Stn., New Orleans, La.  
A relationship of an herbaceous understory (primarily *Andropogon scoparius*) to a *Pinus palustris* overstory in central Louisiana is presented by graphs and equations.
426. HALLS, L. K. 1973. Flowering and fruiting of southern browse species. U.S. Dep. Agric. For. Serv., Res. Pap. SO-90, 10 p. South. For. Exp. Stn., New Orleans, La.  
Flowering and fruiting dates are reported for 14 browse species growing in the open and beneath trees in an east Texas pine-hardwood forest. Predominant overstory species are shortleaf (*Pinus echinata*) and loblolly (*P. taeda*) pines.
427. HALLS, L. K., and R. ALCANIZ. 1971. Forage yields in an east Texas pine-hardwood forest. *J. For.* 69:25-26.  
Forage yield increased in a mature, upland pine-hardwood forest after thinning and prescribed burning. The forest is dominated by shortleaf (*Pinus echinata*) and loblolly pine (*P. taeda*), with a midstory of southern red (*Quercus falcata*) and post oak (*Q. stellata*), hickories (*Carya* spp.), and sweetgum (*Liquidambar styraciflua*).
428. HALLS, L. K., and R. ALCANIZ. 1972. Growth patterns of deer-browse plants in southern forests. U.S. Dep. Agric. For. Serv., Res. Pap. SO-75, 14 p. South. For. Exp. Stn., New Orleans, La.  
Growth rates for browse plants growing in the open and under a forest canopy are graphically illustrated. Studies were conducted near Nacogdoches, Tex., in a stand of shortleaf (*Pinus echinata*) and loblolly (*P. taeda*) pines mixed with hardwoods.
429. HALLS, L. K., and H. S. CRAWFORD. 1965. Vegetation response to an Ozark woodland spraying. *J. Range Manage.* 18:338-340.  
Tables of grass, forb, and browse yields under sprayed (2,4,5-T) and unsprayed stands of post (*Quercus stellata*) and blackjack oak (*Q. marilandica*) are presented for a study area in west-central Arkansas.
430. HALLS, L. K., O. M. HALE, and B. L. SOUTHWELL. 1956. Grazing capacity of wiregrass-pine ranges of Georgia. Ga. Agric. Exp. Stn., Athens, Tech. Bull. N.S. 2, 38 p.  
The relation of grass production to *Pinus palustris* and *P. elliotii* canopy and basal area is given in graphic, equation, and tabular forms for the Alapaha Experimental Range.
431. HALLS, L. K., and W. B. HOMESLEY. 1966. Stand composition in a mature pine-hardwood forest of southeastern Texas. *J. For.* 64:170-174.  
Crown cover, frequency, and density of understory vegetation associated with burned-over loblolly-shortleaf pine-hardwood stands are presented (tables and graphs) for a study area on the San Jacinto Experimental Forest.
432. HALLS, L. K., and R. F. SUMAN. 1954. Improved forage under southern pines. *J. For.* 52:848-851.  
A relationship between herbaceous growth and tree canopy under different site conditions and fertilizer treatments is graphically presented for a study area in southern Georgia. Overstory is dominated by longleaf (*Pinus palustris*) and slash pine (*P. elliotii*) of pole and small sawtimber size.
433. HALLS, LOWELL K. 1955. Grass production under dense longleaf-slash pine canopies. U.S. Dep. Agric. For. Serv., Res. Note 83, 2 p. Southeast. For. Exp. Stn., Asheville, N.C.  
Grass production declines as overhead longleaf pine and slash pine canopies increase, as graphically illustrated for a study area on the Alapaha Experimental Range in Georgia.
434. HALLS, LOWELL K. 1970. Growing deer food amidst southern timber. *J. Range Manage.* 23:213-215.  
A literature review, including a summary of the influence of forest overstories on forage production, is presented for the pine-hardwood forests of the South.
435. HALLS, LOWELL K. 1973. Managing deer habitat in loblolly-shortleaf pine forest. *J. For.* 71:752-757.  
Average forage production in relation to forest density is described. Results apply to much of the loblolly-shortleaf pine-hardwood forest from Virginia to east Texas and Oklahoma. Major overstory species are *Pinus echinata*, *P. taeda*, *Liquidambar styraciflua*, *Quercus* spp., *Carya* spp., and *Ulmus* spp.
436. HALLS, LOWELL K. 1974. Deer browse growth reduced by pine overstory. Southeast. Assoc. Game and Fish Comm. Proc. 27:304-306.  
Table values are given for shrub growth under two levels of *Pinus echinata* and *P. taeda* overstory in east Texas.
437. HALLS, LOWELL K., and HEWLETTE S. CRAWFORD, JR. 1960. Deer-forest habitat relationships in north Arkansas. *J. Wildl. Manage.* 24:387-395.  
The production and availability of forage, as influenced by timber types, age class, crown closure, and grazing, are discussed. Timber types include oak-hickory, cedar-greenbrier, and pine-oak.
438. HALLS, LOWELL K., and JOSEPH L. SCHUSTER. 1965. Tree-herbage relations in pine-hardwood forest of Texas. *J. For.* 63:282-283.  
Logarithmic equations describe grass and herbage production as functions of expressions of forest overstory density. The main tree species forming the overstory are loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*), southern red (*Quercus falcata*) and post oak (*Q. stellata*), sweetgum (*Liquidambar styraciflua*), and hickories (*Carya* spp.).

439. HARLOW, RICHARD F. 1976. Plant response to thinning and fencing a hydric hammock and cypress pond in central Florida. U.S. Dep. Agric. For. Ser., Res. Note SE-230, 7 p. Southeast. For. Exp. Stn., Asheville, N.C.
- Two study areas, a hydric hammock dominated by longleaf pine (*Pinus palustris*), slash pine (*P. elliotii*), and cabbage palmetto (*Sabal palmetto*) and a cypress pond dominated by *Taxodium distichum* var. *nutans* were treated in 3 ways: fenced and thinned, fenced and unthinned, and unfenced and unthinned. Number, coverage, and utilization of woody plants by deer for the two study areas are given (tables).
440. HARLOW, RICHARD F., PAUL A. SHRAUDER, and MONTE E. SEEHORN. 1975. Deer browse resources of the Chattahoochee National Forest. U.S. Dep. Agric. For. Serv., Res. Pap. SE-136, 16 p. Southeast. For. Exp. Stn., Asheville, N.C.
- Browse (choice and other) for 14 forest types in the Chattahoochee National Forest is shown (tables).
441. HART, RICHARD H., RALPH H. HUGHES, CLIFFORD E. LEWIS, and WARREN G. MONSON. 1970. Effect of nitrogen and shading on yield and quality of grasses grown under young slash pines. *Agron. J.* 62:285-287.
- The yield of planted grasses under slash pine (*Pinus elliotii*) overstory after treatment with different rates of nitrogen fertilization is presented (table and graph) for a study area on the Coastal Plains of Georgia.
442. HEIRMAN, ALAN L., and HENRY A. WRIGHT. 1973. Fire in medium fuels of west Texas. *J. Range Manage.* 26:331-335.
- Herbage yields following prescribed burning of honey mesquite (*Prosopis glandulosa*) and velvet mesquite (*P. velutina*) near Lynn County, Tex., are given in tabular form.
443. HODGKINS, EARL J. 1958. Effects of fire on undergrowth vegetation in upland southern pine forests. *Ecology* 39:36-46.
- A literature review, including a description of the change in understory vegetation following burning upland southern pine forests, is presented for an experimental area in northwestern Alabama.
444. HOOK, DONALD D., and JACK STUBBS. 1967. An observation of understory growth retardation under three species of oak. U.S. Dep. Agric. For. Serv., Res. Note SE-70, 7 p. Southeast. For. Exp. Stn., Asheville, N.C.
- The degree of understory vegetation commonly associated with seven species of seed trees is presented (table) for the Santee Experimental Forest in South Carolina.
445. HUGHES, RALPH H. 1975. The native vegetation in south Florida related to month of burning. U.S. Dep. Agric. For. Serv., Res. Note SE-222, 8 p. Southeast. For. Exp. Stn., Asheville, N.C.
- On the Corkscrew Experimental Forest and the Caloosa Experimental Range, plots without trees and ranges dominated by slash pine (*Pinus elliotii*) were burned in October, November, January, March, and May. Herbage yields 30 days, 60 days, and 2 years following treatments on both study areas are graphically illustrated.
446. HUGHES, RALPH H., GEORGE W. BENGTSON, and THADDEUS A. HARRINGTON. 1971. Forage response to nitrogen and phosphorus fertilization in a 25-year-old plantation of slash pine. U.S. Dep. Agric. For. Serv., Res. Pap. SE-82, 7 p. Southeast. For. Exp. Stn., Asheville, N.C.
- Production of herbaceous vegetation following the application of fertilizer to an old-field plantation of slash pine (*Pinus elliotii*) near Olustee, Fla., is graphically illustrated.
447. JOHNSON, A. SYDNEY, and J. LARRY LANDERS. 1978. Fruit production in slash pine plantations in Georgia. *J. Wildl. Manage.* 42:606-613.
- Production of fleshy fruits and hard mast is described in graphs and tabular form for *Pinus elliotii* plantations of different ages on the Georgia Coastal Plain flatwoods.
448. LAESSLE, ALBERT M. 1965. Spacing and competition in natural stands of sand pine. *Ecology* 46:65-72.
- The density of ground cover and spacing of sand pine (*Pinus clausa*) canopy trees in Florida are discussed.
449. LAY, DANIEL W. 1956. Effects of prescribed burning on forage and mast production in southern pine forest. *J. For.* 54:582-584.
- Forage production on burned and unburned pine-hardwood sites is described (tables) for a study area in southeast Texas.
450. LAY, DANIEL W. 1957. Browse quality and the effects of prescribed burning in southern pine forests. *J. For.* 55:342-347.
- The percent of forage in browse is given (table) by date and burning history (burned or unburned) for a loblolly pine forest on the Siecke State Forest in Texas.
451. LAY, DANIEL W. 1967. Browse palatability and the effects of prescribed burning in southern pine forests. *J. For.* 65:826-828.
- Availability of deer browse before and after prescribed burning of longleaf pine is given (table) for a study site on the Siecke State Forest in Texas.
452. LEMON, PAUL C. 1949. Successional responses of herbs in the longleaf-slash pine forest after fire. *Ecology* 30:135-145.
- Changes in density of herbaceous understory on areas having different fire histories are described (tables) for a study area on the Alapaha Experimental Range in Georgia. The forest cover is second-growth longleaf pine and slash pine.
453. LEWIS, CLIFFORD E. 1964. Forage response to month of burning. U.S. Dep. Agric. For. Serv., Res. Note SE-35, 4 p. Southeast. For. Exp. Stn., Asheville, N.C.
- A relationship between herbage yield and time of burning of cutover pine-palmetto flatwoods is described (table and graphs) for study areas in southern Florida.
454. LEWIS, CLIFFORD E. 1974. Grazing considerations in managing young pines. *In* Proc. Symposium on Management of Young Pines. p. 160-170. U.S. Dep. Agric. For. Serv., Southeast Area, State and Private Forestry, and South. and Southeast. For. Exp. Stn.
- Information from the southern and southeastern United States concerning herbage production related to pine (*Pinus* spp.) canopy, basal area, and tree age is given in tabular and graphic forms.



455. LEWIS, CLIFFORD E., and THOMAS J. HARSHBARGER. 1976. Shrub and herbaceous vegetation after 20 years of prescribed burning in the South Carolina coastal plain. *J. Range Manage.* 29:13-18.  
In the Santee and Westvaco Experimental Forests, six burn treatments (annual winter and summer, periodic winter and summer, biennial summer, and no burn) were applied to loblolly pine and hardwood stands to determine treatment effects on forbs, grasses, and grasslike and woody plants. Ground cover and herbage production increases are illustrated (tables and graphs).
456. LEWIS, CLIFFORD E., and RICHARD H. HART. 1972. Some herbage responses to fire on pine-wiregrass range. *J. Range Manage.* 25:209-213.  
Relation of herbage yields to gallberry (*Ilex glabra*) cover (following fire) is discussed (tables) for the Alapaha Experimental Range, Ga.
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Descriptions of understory beneath overstories reduced by chemical and mechanical methods are presented in tabular form.
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Herbage biomass data are presented graphically and in tables. Study was conducted in North Carolina.
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The effect of control of *Serenia repens* on the production of herbage is presented in tabular form.
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Equations are given to describe the relationship between grass and forb production and the age of *Pinus taeda* plantations in eastern Texas.
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Tests at the Middle Tennessee Experiment Station suggest that the presence of well-managed walnut and locust trees may improve the production of seeded forage plants. Tabular values show cattle gains on pastures with and without trees.
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Density, frequency, and basal area of shrubs and woody vines found in three areas of a loblolly pine (*Pinus taeda*) stand subjected to surface fire or crown fire, or unburned are described (table) for a study area on the Duke Forest in North Carolina. Also, the change in frequencies of herbs is given for the three areas.
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Herbage production under different ages of slash pine (*Pinus elliotii*) plantations in Louisiana is given.
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Data given in tabular and graphic form describe the decline of herbage production with increased age of slash pine (*Pinus elliotii*) plantations on the Palustris Experimental Forest in central Louisiana.
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A linear relationship is described between herbage yield and crown cover of slash pine for the Palustris Experimental Forest in central Louisiana.
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Production of herbaceous understory is given for control and herbicide treatment of *Quercus havardii* in west Texas.



473. POWELL, JEFF, and THADIS W. BOX. 1967. Mechanical control and fertilization as brush management practices affect forage production in south Texas. *J. Range Manage.* 20:227-236.
- Graphs of herbage yields with and without mechanical control of a complex of brush overstory species are presented.
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- Percent increase of native grass production as related to percent kill (2,4,5-T) of hardwood overstory is presented in tabular form.
475. READ, RALPH A. 1951. Woodland forage in the Arkansas Ozarks. *J. Range Manage.* 4:391-396.
- A relationship between herbage production and forest (primarily oak-hickory) overstory density is described graphically for upland hardwood range in the Ozarks.
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- Relationship between forage production and forest overstory density is graphically illustrated. Forest composition is predominantly loblolly pine, shortleaf pine, post oak, southern red oak, and hickories.
477. RUSSELL, T. E. 1969. Underplanting shortleaf pine. *For. Farmer* 29:10-17.
- Growth and survival of underplanted shortleaf pine after release (girdle, 2,4,5-T) of hardwood overstory are discussed.
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- Frequency, and production of understory with various stands of loblolly-shortleaf are described in tabular form.
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483. SCIFRES, C. J., and D. B. POLK, JR. 1974. Vegetation response following spraying a light infestation of honey mesquite. *J. Range Manage.* 27:462-465.
- Herbage production with and without the presence of *Prosopis glandulosa* is given in tabular form for a site in Texas.
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- Herbage production on a 30-year protected exclosure and an adjacent grazed area of honey mesquite (*Prosopis glandulosa*) is described. Percentage composition, frequency, and pounds per acre of the three dominant grasses on both study sites are shown (tables).
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- Change in herbaceous production was evaluated on the south Texas plains following herbicide control of mixed brush stands (*Prosopis*, *Acacia*, and *Aloysisia*). Data are presented in tabular form.
486. SCIFRES, C. J., J. L. MUTZ, and G. P. DURHAM. 1976. Range improvement following chaining of south Texas mixed brush. *J. Range Manage.* 29:418-421.
- Grass production and consumption and overstory density are given in tabular form for different chaining treatments. Main overstory species are honey mesquite (*Prosopis glandulosa*), spring hackberry (*Celtis pallida*), and lime prickly ash (*Zanthoxylum fagara*).
487. SEGELQUIST, CHARLES A., and WALTER E. GREEN. 1968. Deer food yields in four Ozark forest types. *J. Wildl. Manage.* 32:330-337.
- In Arkansas, yield of potential deer food under different forest types is presented in tabular form. Forest types evaluated are upland and hardwood, upland pine-hardwood, cedar glade, and stream-bottom hardwood. Combining all forest types, yield of potential deer food increased linearly with decreasing overstory density.
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- Browse yields are given in tabular form for several pine and hardwood overstory conditions.
489. SEGELQUIST, CHARLES A., FRED D. WARD, and ROBERT G. LEONARD. 1969. Habitat-deer relations in two Ozark enclosures. *J. Wildl. Manage.* 33:511-520.
- Five years of summer and late winter vegetation yields are presented tabularly for two exclosures (principal overstory species are *Pinus echinata* and *Quercus* spp.) located on the Sylamore Experimental Forest, Ark.
490. SKROCH, W. A., T. J. SHEETS, and T. J. MONACO. 1975. Weed populations and herbicide residues in apple orchards after 5 years. *Weed Sci.* 23:53-57.
- At the Mountain Horticulture Crops Research Station in North Carolina, apple trees were planted and treated with simazine, diuron, terbacil, paraquat, dichlobenil, and amitrole. Percent control of weeds at three times during the growing season and the botanical composition of a 5-year-old apple orchard as influenced by herbicides and mowing are given (tables).

491. SMEINS, FRED E., TERRY W. TAYLOR, and LEO B. MERRILL. 1976. Vegetation of a 25-year exclosure on the Edwards Plateau, Tex. *J. Range Manage.* 29:24-29. Foliar cover is given in tabular form for both herbaceous and woody plants for different stands. Ashe juniper (*Juniperus ashei*) and Vasey skin oak (*Quercus pungens*) were the most abundant woody species.
492. SMITH, L. F., R. S. CAMPBELL, and CLYDE F. BLOUNT. 1955. Forage production and utilization in longleaf pine forests of south Mississippi. *J. Range Manage.* 8:58-60.

Grass production under dense stands, moderately stocked stands, and open stands of longleaf pine (*Pinus palustris*) overstory is described for the McNeill Experimental Forest.
493. SOSEBEE, RONALD E., W. E. BOYD, and C. S. BRUMLEY. 1979. Broom snakeweed control with tebuthiuron. *J. Range Manage.* 32:179-182.

Data on grass increase following reduction of *Xanthocephalum sarothae* by a herbicide are given in tabular form. Study was in west Texas.
494. STERRETT, J. P., and R. E. ADAMS. 1977. The effect of forest conversion with herbicides on pine (*Pinus* spp.) establishment, soil moisture and understory vegetation. *Weed Sci.* 25:521-523.

Data on frequency and density of understory are given (tables) in relation to herbicidal control of *Quercus* stands in Virginia.
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Herbage characteristics were compared in recently cleared vs. adjacent wooded areas near Nacogdoches, Tex. Overstory dominants were *Pinus taeda*, *P. echinata*, *Liquidambar styraciflua*, and *Quercus falcata*.
496. THILL, RONALD E., and GALE L. WOLTERS. 1979. Cattle production on a southern pine-hardwood forest. *Rangelands* 1:60-61.

Herbage and browse production is given for two levels of *Pinus-Quercus* basal area. Results are from central Louisiana.
497. THROUSDELL, KENNETH B. 1970. Disking and prescribed burning; six-year residual effects on loblolly pine and competing vegetation. U.S. Dep. Agric. For. Serv., Res. Note SE-133, 6 p. Southeast. For. Exp. Stn., Asheville, N.C.

Graphs and a table describe relationships between shrubs and small hardwoods, and loblolly pine (*Pinus taeda*) 6 years after diskings and burning were used to control understory vegetation on a study area in the Virginia Coastal Plain.
498. VECKERT, DARRELL N. 1979. Broom snakeweed: effect on shortgrass forage production and soil water depletion. *J. Range Manage.* 32:216-220.

Tabular production data are given for perennial grasses and *Xanthocephalum sarothae* from studies in west Texas.
499. VOGL, RICHARD J. 1973. Effects of fire on the plants and animals of a Florida wetland. *Am. Midl. Nat.* 89:334-347.

Portions of the shore (dominated by *Cephalanthus occidentalis*) of Gannet Pond (Tall Timbers Research Station, Fla.) were burned. Herbage yields (percent frequency and kilograms per hectare) for the treated and control shorelines are shown (tables).
500. WAHLENBERG, W. G., S. W. GREENE, and H. R. REED. 1939. Effects of fire and cattle grazing on longleaf stands as studies at McNeill, Mississippi. U.S. Dep. Agric., Tech. Bull. 683, 52 p. Washington, D.C.

The changes in herbaceous vegetation following burning of loblolly pine (*Pinus taeda*) overstory are described in graphs and tables.
501. WHITCOMB, C. E. 1972. Influence of tree root competition on growth response of four cool season turfgrasses. *Agron. J.* 64:355-359.

In containers at the Ornamental Horticulture Research Facility (University of Florida, Gainesville), grass production under the shade of and in competition with roots of silver maple (*Acer saccharinum*) and honeylocust (*Gleditsia triacanthos*) was measured. Four types of grasses were also grown with no tree root competition in shade and sun. Results are graphically illustrated.
502. WHITCOMB, CARL E., and ELIOT C. ROBERTS. 1973. Competition between established tree roots and newly seeded Kentucky bluegrass. *Agron. J.* 65:126-129.

A varying number of roots of silver maple (*Acer saccharinum*) and honeylocust (*Gleditsia triacanthos*) were placed in containers at the Ornamental Horticulture Research Facility (University of Florida, Gainesville). Foliage yields of seeded grass for each of the treatments (including no tree root competition) are shown (graphs and tables).
503. WHITTAKER, R. H. 1966. Forest dimensions and production in the Great Smoky Mountains. *Ecology* 47:103-121.

Production of different plant life-forms associated with a forest overstory of many species, principally hardwoods, is given in tabular form.
504. WILLIAMSON, MALCOLM J. 1964. Burning does not control young hardwoods on shortleaf pine sites in the Cumberland Plateau. U.S. Dep. Agric. For. Serv., Res. Note CS-19, 4 p. Cent. States For. Exp. Stn., Columbus, Ohio.

The density of hardwood understory before and after burning of shortleaf pine is graphically illustrated for a study site in Kentucky.
505. WOLTERS, GALE L. 1971. Multiple use planning on southern slash pine range. *Abstr. of Pap., 24th Annu. Meet., Soc. Range Manage., Reno, 1970.* p. 19.

Describes average herbage production under different basal areas of slash pine in central Louisiana.
506. WOLTERS, GALE L. 1973. Southern pine overstories influence herbage quality. *J. Range Manage.* 26:423-426.

Linear relationships of herbage production and chemical composition to pine basal area in central Louisiana are given. Overstory species are longleaf pine (*Pinus palustris*) and slash pine (*P. elliottii*).
507. WOLTERS, GALE L. 1974. Longleaf uniola and spike uniola require shade. *J. Range Manage.* 27:45-47.

Data and graphic illustration of the relation of artificial shading to *Uniola* spp. production and quality are presented for a site in Louisiana.
508. WOLTERS, GALE L., ALTON MARTIN, JR., and WARREN P. CLARY. 1977. Timber, browse, and herbage on selected loblolly-shortleaf pine-hardwood forest stands. U.S. Dep. Agric. For. Serv., Res. Note SO-223, 9 p. South. For. Exp. Stn., New Orleans, La.

Typical understory and overstory associations, with *Pinus taeda* and *Quercus falcata* the predominant overstory species, are described for north-central Louisiana and southern Arkansas.

509. WOLTERS, GALE L., and RONALD C.

SCHMIDTLING. 1975. Browse and herbage in intensively managed pine plantations. *J. Wildl. Manage.* 39:557-562.

Yields of Mississippi Gulf Coast herbaceous vegetation with different levels of pine basal area are described by exponential equation. Herbage and browse production are given for different intensive culture procedures in pine plantations. Planted pines included slash (*Pinus elliotii*), longleaf (*P. palustris*), and loblolly (*P. taeda*).

510. YOUNG, VERNON A. 1952. More grass with post oak gone. *The Cattleman* 38(1):35,44.

Density, composition, and condition classes of herbage associated with cut and uncut post oak overstory in southern Texas are discussed.

## Outside the United States

511. ADAMS, S. N. 1976. Sheep grazing in a young Sitka spruce plantation. *J. Appl. Ecol.* 13:507-511.

To assess the effects of grazing on Sitka spruce (*Picea sitchensis*) in northern Ireland, plots were unfertilized or fertilized, and sheep were allowed to graze on some of the plots. The amount of forage removed by sheep on grazed and ungrazed plots for 5 consecutive years is shown (tables).

512. BAILEY, ARTHUR W. 1970. Barrier effect of the shrub *Elaeagnus commutata* and forage production in central Alberta. *J. Range Manage.* 23:248-251.

Herbage production under and between shrub overstory of silverberry (*Elaeagnus commutata*) is presented in tabular form.

513. BAILEY, ARTHUR W. 1972. Forage and woody sprout establishment on cleared, unbroken land in central Alberta. *J. Range Manage.* 25:119-122.

Competition between seeded grasses and sprouts of aspen (*Populus tremuloides*) and several shrubs is discussed.

514. BAILEY, ARTHUR W. 1978. Use of fire to manage grasslands of the Great Plains: northern Great Plains and adjacent forests. *In Proc. First Int. Rangeland Cong.* p. 691-693. Denver, Colo.

Tabulated data are given for herbage production and standing crop of *Populus tremuloides* in central Alberta, Canada.

515. BAILEY, ARTHUR W., and HOWARD G. 1979. Brush control on sandy rangelands. *J. Range Manage.* 32:29-32.

*Salix balsamifera*, *P. tremuloides*, and *S. sp.* on grass and forb

*tremuloides*) and willow (*Salix* spp.) overstories is given in tabulated form.

517. BOWES, GARRY G. 1978. Advantages of herbicides for brush control on newly seeded rangeland in western Canada. *In Proc. First Int. Rangeland Cong.* p. 651-653. Denver, Colo.

For *Populus tremuloides* stands in Saskatchewan, Canada, tabulated data are given for understory yields beneath tree stands in openings.

518. FIELD, DAVID I., and ALBRECHT GLATZLE. 1978. Monitoring the Kalahari Desert. *In Proc. First Int. Rangeland Cong.* p. 193-197. Denver, Colo.

In Botswana, woody overstory and understory plant cover and density are presented in tabular form.

519. FORD, E. D., and P. J. NEWBOULD. 1977. The biomass and production of ground vegetation and its relation to tree cover through a deciduous woodland cycle. *J. Ecology* 65:201-212.

Herbage production was estimated during a sweet chestnut (*Castanea sativa*) coppice cycle in southeastern England. A logarithmic function describes the relationship, which is graphically displayed.

520. GRUNOW, JULIUS O., and OCKERT J. H. BOSCH. 1978. Above ground annual dry matter dynamics of the grass layer in a tree savanna ecosystem. *In Proc. First Int. Rangeland Cong.* p. 229-233. Denver, Colo.

Biomass values for open and canopied sites are given for the *Eragrostis paliens-Burkea* tree savanna in South Africa.

521. HILTON, JAMES E., and ARTHUR W. BAILEY. 1974. Forage production and utilization in a sprayed aspen forest in Alberta. *J. Range Manage.* 27:375-380.

Tabular data present the effect of aspen (*Populus tremuloides*) overstories on forage production.

522. HIRST, STANLEY N. 1975. Ungulate-habitat relationships in a South African woodland/savanna ecosystem. *Wildl. Monogr.* 44, 60 p.

Tabular data are presented on shade cover of woody species and ground cover for herbaceous species in different vegetation types.

523. KNOWLES, R. L., B. K. KLOMP, and A.

GILLINGHAM. 1973. Trees and grass: an opportunity for the hill-country farmer. *New Zealand Farmer*, Sept. 13, 1973. (From Kirby, J. M., 1976. A technique for the tropics-forest grazing. *World Crops* 28:248-251.)

In New Zealand, expected forage production as a percent of open pasture is given (table) for *Pinus radiata* plantations.

524. McLEAN A., T. M. LORD, and A. J. GREEN. 1971. Utilization of the major plant communities in the Similkameen Valley, British Columbia. *J. Range Manage.* 24:346-351.

Herbage yields associated with climax plant communities are given in tabulated form. Plant communities evaluated include ponderosa pine—Idaho fescue, Douglas-fir—bluebunch wheatgrass, Douglas-fir—Idaho fescue, Douglas-fir—pinegrass, and Idaho fescue-erigonum.

525. MacLEAN, DAVID A., and ROSS W. WEIN. 1977. Changes in understory vegetation with increasing stand age in New Brunswick forests: species composition, cover, biomass, and nutrients. *Can. J. Bot.* 55:2818-2831.

Tabular and graphic data are presented for *Pinus banksiana* and hardwood (*Prunus*, *Acer*, *Populus*, and *Betula*) stands.

526. MAIGNAN, FERAULD. 1978. Productivity of *Lolium rigidum* in a forest of oak trees (*Quercus suber*). *In Proc. First Int. Rangeland Cong.* p. 239-241. Denver, Colo.

Understory yields under oak overstories in Morocco are presented in tabulated form.

527. McQUEEN, D. R. 1973. Changes in understory vegetation and fine root quantity following thinning of 30-year *Pinus radiata* in central North Island, New Zealand. *J. Appl. Ecol.* 10:13-21.
- Percent cover of understory species in thinned and unthinned *Pinus radiata* stands is shown tabularly, while dry weights of the understory fine roots for the two treatments are graphically illustrated.
528. POTVIN, FRANCOIS, and JEAN HUOT. 1971. Deer browse production in small cutovers in southern Quebec. *Wildl. Soc. Bull.* 7:247-252.
- The number of twigs and biomass of browse available to deer in each of the first 6 years after clearcutting hardwoods (mostly *Acer rubrum*) in mixed forests are summarized in tabulated form.
529. PRATCHETT, DAVID. 1978. Effects of bush clearing on grasslands in Botswana. *In Proc. First Int. Rangeland Cong.* p. 667-670. Denver, Colo.
- Dry matter production and botanical composition with and without bush clearing are given.
530. PRATT, D. J., and J. KNIGHT. 1971. Brush-control studies in the drier areas of Kenya vs. effects of controlled burning and grazing management of *Tarchonanthus/Acacia* thicket. *J. Appl. Ecol.* 8:217-237.
- Four study sites in the Rift Valley were burned differently: unburned, burned once, burned three times without previous slashing, and burned three times following slashing. Herbage production for the four sites is presented in tabulated form.
531. PRINGLE, W. L., C. R. ELLIOTT, and J. L. DOBB. 1973. Aspen regrowth in pastures of the Peace River region. *J. Range Manage.* 26:260-265.
- Four consecutive years of forage yields following various tillage methods of *Populus tremuloides* sprout control in northern Canada are given (table).
532. PURDIE, R. W. 1977. Early stages of regeneration after burning in dry sclerophyll vegetation. I. Regeneration of the understory by vegetative means. *Aust. J. Bot.* 25:21-34.
- Density of understory vegetation is given in tabulated form for control stands and for *Eucalyptus* stands thinned by fire in Australia.
533. SCOTTER, GEORGE W. 1975. Effect of picloram on cinquefoil and forage production at the Ya-Ha-Tinda Ranch, Alberta. *J. Range Manage.* 28:132-138.
- Herbage production with and without the presence of *Potentilla fruticosa* is given in tabulated form.
534. SKOVLIN, JON M., and D. LEROY WILLIAMSON. 1978. Bush control and associated tse-tse fly problems of rangeland development on the coastal plain of East Africa. *In Proc. First Int. Rangeland Cong.* p. 581-583. Denver, Colo.
- Grass, bush, and composition data are presented in graphic form. Overstory species include *Acacia zanzibarica* and *Hypaene thebaica*.
535. STRANG, R. M. 1974. Some manmade changes in successional trends on the Rhodesian highveld. *J. Appl. Ecol.* 11:249-263.
- The effects of clearcutting, burning, and grazing on the overstory (*Brachystegia spiciformis/Julbernardia globiflora*) and understory vegetation in northeastern Rhodesia were studied. Mean relative densities of grasses on burned, grazed, and protected sites are discussed (tables).
536. TEFLER, E. S. 1972. Understory biomass in five forest types in southwestern Nova Scotia. *Can. J. Bot.* 50:1263-1267.
- Herbaceous and shrubby biomass is presented in relation to biomass and basal area of different forest types. Information is presented in tabulated and graphic form for stands dominated mainly by *Picea*, *Abies*, *Acer*, *Populus*, and *Quercus*.
537. VAN NIEKERK, J. P., F. V. BESTER, and H. P. LOMARD. 1978. Control of bush encroachment by aerial herbicide spraying. *In Proc. First Int. Rangeland Cong.* p. 659-663. Denver, Colo.
- From South Africa, grass production with and without chemical control of mixed bush overstories is given in tabulated form.
538. VELEN, T. T., D. H. ASHTON, F. M. SCHLEGEL, and A. T. VELEN. 1977. Distribution and dominance of species in the understory of a mixed evergreen-deciduous *Nothofagus* forest in southcentral Chile. *J. Ecol.* 65:815-830.
- Frequency and cover of understory species are given for several forest types.

## APPENDIX

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This annotated bibliography is provided as a working tool for natural resource specialists and land-use planners attempting to (1) describe understory production, density, or composition associated with specific overstories; or (2) changes in understory characteristics resulting from conversion or modification of specific overstories.

**KEYWORDS:** bibliography, annotated, understory, overstory, relationships

#### PESTICIDE PRECAUTIONARY STATEMENT

This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

**CAUTION:** Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife--if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.



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